Electrical World

The consolidation of Electrical World and Engineer and American Electrician
Published by McGraw Publishing Company, Inc.

Vol. 61 NEW YORK, SATURDAY, APRIL 5, 1913 No. 14

Why Was Dayton S Isolated?

Not by way of finding fault with anybody in this period of distress and disaster caused by record floods, but simply in the search for information, we rise to inquire in the name of civilization and invention why Dayton was allowed to be so utterly cut off for days from the rest of the world? To be a little more explicit—for it is easy to say what we mean—why in these days of the wireless telegraph should Dayton be even more isolated than was the *Titanic?* Anybody would think that the wireless telegraph had never been heard of in Dayton or Ohio. Why, when they know that their wires are breaking all the time, do telegraph and telephone companies so persistently neglect adding the wireless to their standby emergency forces? If we were finding fault, we should say that such neglect of an obvious and cheap remedy is scandalous and reprehensible. We simply ask, why? We shall be glad to hear from some of our readers on the subject, and particularly from the companies. And, then, again, why should Dayton, birthplace of the modern aeroplane and a leading home of its manufacture, go without any resort to that useful device at such a juncture? It should have been the easiest thing in the world to fly into Dayton or out of it at any time last week, even when the floods were at their worst, either by aeroplane or hydroplane, or flying boat. Why did not somebody do it? Again, we say, this is all by way of inquiry; but when modern civilization has such resources at its instant command it does seem most mysterious that they should not be ready and waiting to be availed of at the very instant such emergencies arise.

Driving the Entering Wedge

Those who sat through the six busy and teeming sessions of the recent convention of the Society for Electrical Development profited by hearing much practical commercial talk and many excellent dollar ideas. One of the most important lessons there driven home pertained to the ways—and the number and diverseness of them—in which the central station can make its start in converting a local field or industry to the use of electrical service. With one such entering wedge driven the rest of the battle is easy with mere routine methods. The difficulty, it has seemed, has always been in making the start. Yet to make this start the astute commercial man has the whole gamut of human motives on which to play. He can direct such arguments as those of originality, modernity, safety, economy and simplicity on the most likely candidate for electrification, sometimes bringing personal influence to bear through mutual connections. A new factory is to be built or a new hotel equipped. Consider the numerous and effective arguments which can be urged for electrifying it completely, especially if such equipment constitutes a point of originality compared with others of the same class. And with such an example once established in the locality or the industry the conversion of the rest becomes the province of simple routine sales work. With a fair share of imagination and a grasp of human nature, the way of the new-business man, then, should not be hard in making these initial sallies in advance of the battle-line of electricity-selling effort.

Raw-Water Ice-Making

The phenomenal consolidation of small central-station plants into interconnected transmission systems which is taking place has a significant sequel in the problem of combination ice-electric operation. With the shutting down of steam-boiler plants in remote communities and their replacement by chimneyless transformer substations, the local combination ice-plant operator must look elsewhere for his supply of distilled water and of steam power for ammonia-compressor operation. He can, of course, drive his ice machine by an electric motor, but without distilled water can he depend on producing clear, clean ice which will be attractive to the consumer? Fortunately, the refrigerating industry stands ready with the answer—two answers, in fact, each vigorously affirmative and each proved by years of successful operation. Beautifully clear and flawless ice *can* be produced without a steam plant. Dozens of boilerless plants are freezing a perfect and transparent product, but in the ice business, as in some of the other older industries, prejudice and preconceived impressions die with difficulty and plenty of practical men can still be found to deny all virtue to any ice-making outfit not equipped with a roaring furnace, boiler plant and steam-eating compressor. The operator who encounters the problem of making ice from raw water and electrical energy can secure one of several successful raw-water systems in which the water is agitated by air during freezing, the concentrated impurities being drawn off with the core water. Or if he prefers he can install a system of re-evaporators in which a very little heat is employed with multiple effect to distil successively several times the original quantity of water, thus securing the maximum of thermal economy. And as for the old belief that distilled water makes purer ice than raw water, it must be evident upon the brief study that with proper removal of the core liquid, raw-water ice, obedient to Nature's law, "freezes itself pure," pushing foreign matter ahead to be drawn off with the core waste. In distilled-water ice the core impurities remaining in the water are likely to be frozen into the center, so that it is not clear but that the raw-water folk have the best of the argument even on this point.

High-Powered Radio Signaling

Within the past two months a scout cruiser has for the second time been sent some 3500 miles to sea for the sole purpose of determining the possibilities of communication by radio telegraphy. In 1910 the United States cruiser *Birmingham* crossed to Liberia, working by "wireless" with the plant at Brant Rock, Mass., for a large part of the trip; and on Feb. 15, 1913, the cruiser *Salem* left the League Island Navy Yard, proceeding to Gibraltar. Throughout almost the whole of the cruise she was able to receive from the new naval radio station at Arlington, Va., complete messages by daylight being read from a distance as great as 2600 miles and very loud signals occurring nightly while the ship lay at Gibraltar.

In this issue we present an article, by engineers closely identified with the work, describing in detail the equipment placed aboard the *Salem* and at Arlington and giving many new data as regards the test itself. One of the most interesting points brought out is the extreme compactness of the entire Arlington installation, as contrasted with the large space used by other modern radio stations of approximately the same signaling range. This seems to be due in a large measure to the employment of a high-tension condenser design quite novel in wireless transmitters. Metallic plates supported close together in air at atmospheric pressure are known to form a condenser having practically zero losses at any frequency but limited in its power-storing ability for a given bulk on account of the relatively low dielectric strength and specific inductive capacity of air. However, when the entire condenser group is placed in a tank and the air pressure within is brought up to some 300 lb. per square inch the rupturing voltage becomes so high that large amounts of energy may be stored in quite low capacities, and the bulk for a specified rating of condenser is remarkably small. The entire condenser bank at Arlington (including spares) covers a floor space only about 10 ft. by 15 ft., yet each unit is instantly accessible for alteration of connections.

A further striking point of the installations is that they are the first made by the government which are described as having the heterodyne receiver. Those familiar with Professor Fessenden's description of this receiver, as given at the A. I. E. E. convention in Atlantic City some years ago, will recollect that its performance depended upon the interaction of two persistent high-frequency currents—one locally generated at the receiver and the other set up by the received wave energy—to produce an amplified audible or other response. This device has now been developed to the point at which it is said to give increased indications over those normally had on the receipt of fairly well sustained waves, yet, because of its requirement of a considerable degree of persistence for amplification, it does not add to the false signals produced by highly damped atmospheric disturbances. The fact that messages were sent in daylight from the *Salem*, with only 10 kw of transmitting power available, and received at Arlington by two operators simultaneously over a distance of 1300 miles, seems to indicate that a practical solution of many difficulties in radio work has been made by the adoption and development of this type of receiver.

Consideration of the distances communicated across during the trials at once leads to the question of what distance could be covered between two large stations of the Arlington type. If another plant similar to that near Fort Myer should be erected at some distant point it would have two great advantages, as compared with the ship, in receiving from Arlington, since not only would the effective height of the receiving antenna be increased from 130 ft. to 450 ft., but it would be possible to make efficient use of very long waves and thereby minimize the daylight absorption. It does not seem improbable that by using waves 6000 m in length transmission might be effected over 500 miles. The distances over which actual daylight transmission of messages was made during the test are a matter of congratulation within our navy and indicate a distinct national achievement in radio signaling.

A Study in Heterochromatic Photometry

It is somewhat disconcerting after recent investigations had given one a somewhat comfortable feeling about the comparison of lights of different colors to find a new illuminant turning up which seems to upset all precedents and to defy all customary procedures. A recent paper by Broca, La Porte and their colleagues dealing with the photometry of neon tubes casts a bombshell into the photometric camp and demands prompt study and confirmation. The neon tube, as our readers will remember, is the latest development of vacuum-tube lighting. It gives a light of a beautiful deep orange at high efficiency and at low intrinsic brilliancy and therefore gives good promise of commercial usefulness. In attempting to establish the luminous value of such a tube Broca and his colleagues fell into unexpected and extreme difficulties. The color of the light seemed to interpose an insurmountable obstacle in the path of precision. The light from a meter length of the neon tube was balanced against that from a 4-watt-per-candle carbon standard lamp on a photometer provided with a Ritchie prism as indicator. The results were startling and discomforting, for ten observers found values for the neon tube scattered without any appearance of regularity between 62 cp and 205 cp.

There was nothing out of the ordinary in the intensities at which the balances were made, the values of the illumination on the prism faces ranging between 1 ft.-candle and 3 ft.-candles. The investigators go so far as to say that while with all the usual commercial sources of light one can get an average value of the illumination by the work of several observers, for the neon lamp the mean of the various determinations has no practical value whatever. Here is a pretty mess indeed, if the statements are borne out by other investigators.

For some reason as yet undiscovered, the red sensation seems the one most subject to abnormalities, and Rayleigh found some years ago that a certain proportion of eyes are hypersensitive to red just as another proportion are subsensitive. It is, however, a stretch of the doctrine of probabilities to suppose that most of the ten observers concerned in this case had abnormal red vision, although some of them may have been thus afflicted. Another cause, however, may

have contributed to the confusion. It has been pretty well established that the cause of the ordinary abnormalities in comparing lights of different colors is the very powerful simultaneous contrast which tends to throw the colors apart in spectral range and to substitute correspondingly false subjective values of the luminosities. The effect of simultaneous contrast varies from eye to eye and from one condition of adaptation to another, so that it is quite easy to see that considerable variations due to this cause are possible. In addition to the purely photometric difficulties, the investigation of M. Broca and his colleagues showed a marked Purkinje effect for the neon tube and also a somewhat enhanced visual acuity, as might be expected from the quasi-monochromatic character of the neon spectrum. The intrinsic brilliancy of the neon tube proved to be about 0.3 cp per square cm, a figure obviously very favorable from the point of view of illumination, and, as one might suppose, the after images produced were relatively brief.

M. Broca and his colleagues speak highly of the neon tube as producing very slight ocular fatigue, but its photometry from their experiments presents a discouraging problem. It is certainly desirable that these experiments be repeated and that the discrepancies observed be explained or eliminated in so far as it is possible to do so. Unhappily, the flicker photometer does not lend itself readily to the work on account of the oscillatory nature of the discharge in the tube. The whole affair is somewhat mysterious and should be examined by other photometrists without delay.

Cyclic Variation in Candle-Power

That the candle-power of an incandescent lamp fluctuates cyclically when operated with alternating current has long been known and in a broad sense is self-demonstrating, the only question being as to how great the fluctuation may be. Naturally, on low-frequency circuits, with thin high-voltage, high-efficiency, high-temperature filaments, the fluctuation will tend to be the greatest. It has been measured in the past by observing the cyclic change in the ohmic resistance of the filament, as determined by potentiometer and cyclically rotating contactor. From the cyclic change in filament resistance, the corresponding cyclic change in candle-power has been inferred.

In the *Digest* of this issue appears an account of an interesting series of stroboscopic tests by Prof. A. Larsen on a 9-cp, 220-volt Osram lamp operated with 50-cycle current. The candle-power was found to vary cyclically between 70 and 134 per cent of normal; that is, the candle-power at the peak of the wave was not far from double that at the zero. This was the most marked case. Other Osram lamps, either of larger filament and candle-power or of lower voltage, showed less fluctuation.

A second important result reported in the article is that the candle-power of a 9-cp, 220-volt Osram lamp is appreciably greater with alternating-current than direct-current supply of equal voltage. The increase is stated to be 1.6 per cent at 50 cycles per second and 3.7 per cent at 30 cycles per second. Here again the result is attributable apparently to the very thin filament needed in a 220-volt, 9-cp lamp. So far as we are aware, no definitely appreciable difference in candle-power has been reported in American 110-volt lamps of 10 cp on direct-current and alternating-current equal-voltage supply. According to the results given in the article, such differences should, however, become perceptible with 25-cycle supply. A third interesting result mentioned in the article is that, owing to a nearly two-to-one range in cyclic candle-power of a 9-cp, 220-volt Osram lamp, at 50 cycles, such a lamp may be used in slip-frequency stroboscopic measurements, on induction motors, without resorting to the usual alternating-current arc lamp.

It is noteworthy that at equal candle-powers the tested Osram lamp showed no perceptible difference in power consumption, at terminals, whether operated from alternating-current or direct-current mains. With an appreciably perceptible difference of candle-power on equal-voltage alternating-current and direct-current mains, as reported, it would be reasonable to expect that such thin-filament Osram lamps would show distinctly different lifetimes in the two cases. It would be interesting to find whether the expected change in lifetime would correspond to the change in candle-power on a direct-current circuit. Let us hope that someone will undertake such tests on an elaborate scale, because unless they include the behavior of at least fifty selected lamps in each tested batch, not much reliance can be placed on the results.

Mercury-Arc Rectifiers for Energy Distribution

The mercury-arc rectifier has taken a well-recognized position in modern electric industry for charging storage batteries for alternating-current mains and also for supplying series arc lamps from alternating-current constant-current transformers. Its development in this country has been largely due to the work of Dr. Peter Cooper Hewitt. The original discovery of the rectifying action of a carbon-mercury arc has recently been claimed in *La Revue Electrique*, by M. Daniel Berthelot, for two French physicists—Messrs. Jamin and Maneuvrier—in 1882, with reference to their publication of the discovery in the *Journal de Physique* for that year.

Important as the use of the mercury-arc rectifier has already become, it is perhaps insignificant compared to what might be expected to develop if a reliable and not too expensive rectifier of the same type could be developed for larger currents and powers. Experiments in this direction have been going on for years in the large manufacturing establishments of this country and of Europe, and with at least a fair measure of success. In Germany one or two 100-kw rectifiers are reported as operating on 220-volt circuits. The structural difficulties to be overcome are manifestly very considerable, because glass vacuum chambers have to be abandoned when large currents are used, and metal vacuum chambers are hard to maintain gas-tight under wide ranges of temperature. It is earnestly to be hoped, however, that the efforts of the engineers engaged in this work will be successful, as their success might mean the elimination of revolving machinery in substations.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Damage by Floods to Electrical Properties

"We are undismayed; we are still optimists" is the cheering message received from the president and manager of the Dayton Power & Light Company, Mr. Frank M. Tait, president of the National Electric Light Association, who was lost to the outer world for two days and three nights, while marooned with his family on the second floor of their home.

Swollen by heavy rainfall and spring freshets to levels which in many instances were the highest in local history, the Muskingum, Scioto, Miami, Wabash and many other rivers of less importance, which with their tributaries drain vast portions of Ohio and Indiana and empty into the Ohio River, burst their banks last week and spread over the surrounding territory.

Rising waters in Illinois, Kentucky, West Virginia, Tennessee and parts of Virginia, Pennsylvania and upper New York also swept across portions of these States, and as this issue goes to press many sections in the Southern States are beginning to feel the devastating effects of the deluges that are pouring in upon them from above.

As is already known, many of the most prosperous cities, towns and smaller communities, possibly fifty in number, in Ohio and Indiana, having extensive manufacturing and agricultural interests, have suffered heavy damage from the floods. These seemed to reach their greatest heights between March 25 and March 28. Estimates that have been made of the loss of life and property in the stricken districts are naturally inaccurate at this time owing to widespread interruption of railroad, telegraph and telephone service in these sections, and full details are difficult to ascertain.

Thousands of people have been made homeless, however, several hundred lives have been lost, property damage is estimated at several hundred millions of dollars, and the transaction of business has been rendered impossible in wide areas.

In the Ohio, Indiana and northern New York districts the waters are receding rapidly and information obtained concerning the extent of damage indicates that first reports contained many exaggerations.

Help in the form of money, food and clothing has poured into the relief stations established in all of the large cities for the benefit of the flood sufferers and offers of assistance have been received from abroad. Considerable headway is now being made in the work of rehabilitation.

Electrical interests suffered extensively in the floods, but not to any such degree as was first supposed. Generating stations and substations were partly submerged in a number of localities. Overhead poles were undermined or washed away or torn down by floating debris; lines of wire crossing bridges went down with the latter in many instances, and the swift action of the water undermined foundations and carried away the ballast of street railway and interurban lines.

It is believed that never before in the history of the United States has there been such a general prostration of telephone and telegraph wires as existed in the flood-swept districts on March 27. That the loss of public utility property was not greater was due to the resourceful and heroic measures followed by managers of electric-service properties and the loyalty with which these men and their subordinates, with the waters rising about their plants, torn by anxiety for relatives, friends and personal property, stuck to their posts in the interest of their employers and thousands of fellow-townspeople.

Dayton, Ohio, is one of the chief victims of the flood. Electrical men all over the country expressed keen anxiety when reports from that city brought no word as to the safety of Mr. Frank M. Tait, president of the National Electric Light Association and also president of the Dayton Power & Light Company. Word was received in New York on the afternoon of Saturday, March 29, that Mr. Tait and his family were safe, and his message to the electrical industry at large, through the *Electrical World*, is given above.

Telegrams from members of the staff of the *Electrical World*, describing electrical conditions as seen by them in the flooded districts, dispatches and letters from managers of public-utility properties appear below.

Ohio

Dayton, Ohio (*By Telegraph*).—"We are undismayed; we are still optimists," was the spirited declaration of Mr. Frank M. Tait to a representative of the *Electrical World* who visited the stricken city with the first resumption of railroad communication after the crest of the flood had subsided. Mr. Tait, with his wife and child, was for two days and three nights marooned in the upper story of his house, while grave fears were being entertained for his safety among his electrical friends throughout the country. After getting his family to safety, he himself set an example to his organization by working day and night, and began giving street-lighting service Sunday evening, March 30.

The response of outside interests in coming to the aid of the Dayton central-station company has been fine and is deeply appreciated, declared Mr. Tait. No more electrical apparatus need be sent, however, unless requested, he added. If further assistance is required, the nearest source will be called upon. The company's own organization is well in hand and everything is moving ahead.

Resumption of Central-Station Service

By the end of the present week the central station expects to have full service restored to all except the submerged districts. The Fourth Street direct-current station was in partial operation by Wednesday, while the large Third Street station was meanwhile being dried out. The death of one lineman constituted the only loss of life among the company's employees. For fifty hours the plants were under water, which was 12 ft. deep over the engine-room floor at the Fourth Street plant and 6 ft. at Third Street. Adding to the difficulty, the receding waters left a foot of mud covering everything.

Dayton has displayed indomitable spirit in coping with its great calamity. The flood caused nearly 100 deaths and millions of dollars' worth of property damage. Half a million of this loss will be borne by the electrical interests. Every business establishment in the central district sustained

serious damage. While it is likely that every electrical concern is crippled, the electrical men of Dayton remain courageous and cheerful.

Help from Other Cities

Without waiting for an appeal for aid, electrical interests in other cities began rushing men and material to Dayton at the first news of the disaster. Twenty electrical engineers were dispatched from the New York Edison Company, and ten came from the Commonwealth Edison Company, Chicago. The Dayton company operated its own commissary during the days of the flood emergency, impressing the services of its stenographers to peel potatoes and aid in preparing food for the workers.

Dayton has long held the well-earned title of "The Electric City," and the great dependence of the community on its central-station service required that operation be restored at the earliest possible moment. Probably 85 per cent of the city's available industries are on the company's circuits. Telephone and fire-alarm systems also depended for their power supply on central-station service. Of the special ornamental street-lighting posts for which the downtown streets of the city were notable, 125 were broken off or twisted out of shape by the force of the waters.

FIG. 1—TYPICAL GENERAL VIEW IN THE FLOODED DISTRICT—JOHNTOWN, IND., AFTER WATER HAD BEGUN TO RECEDE

First Uses for Central-Station Energy

With the resumption of electric service energy was furnished to the relief headquarters, the local newspapers, and to a mattress factory to make mattresses for the sufferers. A few street cars began running early in the week but no fares were accepted. The interurban line from Dayton to Xenia also started, the passengers being required to cross the Little Miami River by a small foot-bridge.

With assistance from other cities, the Dayton company soon had twenty-five experts at work making every effort to restore operating conditions. High-class engineers aided in cleaning mud out of the plants, while volunteers did heroic work. Shortage of coal, however, remains a menace to many utility plants in the flood-devastated districts. Important first-aid service rendered by the Dayton central-station company was in emergency lighting and the pumping of basements.

Among Dayton electrical interests, nearly all the local manufacturers and supply dealers suffered more or less, among those bearing the heaviest losses being the Dayton Electrical Laboratories, William Hall Electric Company, Gibbons Fixture Company, Platt Iron Works, Globe Electrical Company, and others.

Mr. John W. Lieb, Jr., vice-president and general manager of the New York Edison Company, while in Detroit last week, received word from Mr. Anthony N. Brady of the situation in Dayton and left immediately for that city to give such aid as he could to the public-utility men there in establishing the electrical service.

At Cleveland he met Mr. S. G. Rhoades, of the New York company, in accordance with business plans made before the disaster, and together they went on to Dayton, reaching there at sunrise on Friday morning, March 28.

At 4 p. m. on March 29 Mr. Lieb telephoned to his New York office, by way of Springfield, Ohio, that Mr. Frank M. Tait, president of the Dayton Power & Light Company and of the National Electric Light Association, from whom no word had been learned, had been found.

On March 30 sixteen men from the staff of the New York Edison Company were sent to Dayton to render any assistance within their power. These men were from the electrical construction, underground, overhead and meter departments.

With the party went Messrs. W. Hill, electrical superintendent; W. T. Dempsey, superintendent of the arc-lighting department; Alexander Maxwell, chief of the testing laboratories, and Samuel Ring, deputy underground superintendent of the Bronx district.

According to advices reaching the office of the New York Edison Company early this week, the overhead lines in Dayton were not seriously affected by the floods and the underground service was only slightly damaged. One unit was placed in operation on the night of Sunday, March 30, and service established in part of the city.

Mr. M. B. Stohl, wire chief of the Central Union Telephone Company at Dayton, kept the outside world partially informed of the conditions in the center of the submerged district of that city during the worst part of the flood. He reached the Dayton office on the morning of March 25 just before the flood broke. The storage batteries and ringing generators were quickly put out of commission by the rising water. Realizing the interruption to communication with the outside world, he quickly connected a lineman's test set to one of the outgoing toll lines and made his headquarters on the roof of the local telephone company's buildings. Over this improvised line he held conversation with Mr. C. D. Williamson at the telephone test station at Phoneton, a little suburb about ten miles north of Dayton and out of reach of the flood. This line remained intact even after the flood reached a considerable height as the connections were underground. All other reports sent to or received from Dayton during the flood period were handled through stations outside the submerged area.

Mr. John T. Greene, superintendent of the fire-alarm and police-telephone service of Toledo, left for Dayton early on the morning of March 31, accompanied by two linemen, to assist in rehabilitating the fire and police-alarm service of Dayton, which was put out of commission by the floods.

Dayton is one of the important interurban-railway centers of the United States, seven traction lines radiating from it. It is said that these electric railways have a combined mileage of 700 miles.

Columbus, Ohio (*By Telegraph*).—The Erner & Hopkins Company's electrical supply house, Columbus, is completely flooded and burned out. Electrical supplies have been started from this city to Dayton.

Under normal conditions, electrical energy is supplied in Columbus principally by the Columbus Railway & Light Company. In addition, there is the municipal lighting plant in the penitentiary, which supplies the State House and other state institutions. All of these plants were more or less damaged by the flood, as they are located on low lands near the junction of the Olentangy and Scioto Rivers.

The flood came up very quickly on the morning of March 25. Owing to excessive rainfall it is said that the water rose 15 ft. in three hours. By 8:30 a. m. there was 6 ft. of water on the floor of the principal central-station plant. Fortunately, the old Edison plant on high ground in the center of the city was in service, and by starting up three old plants usually held in reserve the Columbus Railway & Light Company was able to give lighting service and partial railway service with comparatively slight interruption.

In accomplishing this the storage-battery reserve was very useful. The output was 220-volt and 500-volt direct current only during the first few hours of the flood. It was the old plants that saved the day in Columbus. The company is proud of the fact that the old Edison station has a record of service of never being without energy in the busbars.

By 6 p. m. on March 25 some cars were running in the higher portions of the city. The alternating-current supply was off for a short time, but nearly all lighting demands were supplied by the night of the 25th. Industrial service was restored practically by March 31. The factories in the flooded district could not very well have used energy before that time. To be as economical as possible, users of electric signs were requested not to light them at first.

On the West Side of Columbus about seven persons lost their lives owing to the floods. The central-station company procured boatmen from Buckeye Lake and sent them to the relief of its employees. The greatest damage was done by the breaking of the levees after they had held until the water had risen above them. The breaks then caused a difference of head which permitted the water to sweep over the inundated districts with terrific force. There was a panic on March 26 owing to an unfounded report that the storage reservoir had gone out.

As a matter of fact, it is unlikely even if this added calamity had happened that greater damage would have been done than by the breaks in the levees occurring in the manner described above.

In the main power house of the Columbus Railway & Light Company the alternating-current board was abandoned for a week. This plant contains nine 500-volt alternating-current units. By March 30 a 1500-kw turbo-alternator was in operation, the energy being controlled from temporary structures outside the power house.

To dry out the units, they were boarded up and hot air was circulated through them by means of temporarily gas-heated furnaces. The machines were also run under their own power on short-circuit to dry them out, the application of heated air expediting the process.

The municipal plant supplying arc and incandescent street lighting and some power customers was out of commission for nearly a week. The state penitentiary plant suffered loss merely from damaged transformers. For a time it was not able to give electricity to the State House. The central-station company was able to give emergency service to the offices of the Governor and Adjutant General.

Under trying conditions, the local company managed to get a telephone message through to the General Electric Company. Connection was broken off before the message was completed, but the manufacturers sent all spare parts thought necessary without waiting for instructions. Mr. E. P. Waller and three men were sent from Schenectady to Columbus and their services and the prompt help of their company were greatly appreciated. Mr. J. R. Lovejoy, of Schenectady, who happened to be in Columbus, was marooned there during the flood. Messrs. S. G. McMeen, president of the local company, and M. S. Hopkins, of E. W. Clark & Company, were in charge of the emergency rehabilitation and they worked like Trojans. Mr. W. A. Hopkins was in charge of the boat relief service of the company. All employees and their families were saved except the wife and child of one man.

Telephone and telegraph service was interrupted for several days. The Jeffery Manufacturing Company's plant was not injured and was of great service to other interests. The plant was thrown open for emergency work, and the vacuum drying ovens especially were very useful. Street-railway motors and other machinery that could be carried were dried out in this way. The Columbus Buggy Company, manufacturer of automobiles, sustained some damage.

Akron, Ohio.—At this place the basements of the Northern Ohio Traction & Light Company's power houses were filled with water, interfering with operation for a short time. The company's tracks in the lowlands were covered with water, necessitating the transferring of passengers.

Officials of the company stated this week that the flood was the worst ever known in their section of the country. They estimate the losses at this time not to exceed $10,000 in property and $15,000 in revenue. They expected to be in full operation by April 1.

Chillicothe, Ohio.—At Chillicothe, Ohio, on the Scioto River, on March 28, the city was without electricity, gas or water supply. The river was falling at the time, however.

Cincinnati, Ohio.—Newspaper reports state this week that the public utilities had suspended operations and that no electric service was being furnished.

Representatives of A. B. Leach & Company, New York, who are interested in the Columbia Gas & Electric Company, operating in Cincinnati, said this week that they knew of no difficulties experienced by that company from the floods. The stage of the river reached 68.6 ft. on the night of March 31.

Cleveland, Ohio.—The Western Ohio Railroad Company, Cleveland, had a 160-ft. two-span bridge washed out at Lockington, Ohio, and its train service was interrupted on March 25. Its other losses will not exceed $1,000. There was no interruption of its power and lighting service.

The plant belonging to the Cleveland Electric Illuminating Company on the Cuyahoga River bank was flooded last week for several days. One of the feeder switchboards, located underground, was entirely submerged and much of the apparatus in the basement was in the same condition. Finally the large turbines were also submerged. By Saturday, however, they had been dried out and put into operation again.

To take care of the demands for service the feeders were connected up with the new central station and, by having all the light and power load possible cut off in the large office buildings and factories, the company managed to maintain service in all parts of the city, except for a short period when the West Side was in darkness.

Coshocton, Ohio.—The station at Coshocton was flooded and during the high-water period the town was in darkness.

DEFIANCE, OHIO.—Properties of the Auglaize Power Company, Defiance, which has a hydroelectric plant on the Auglaize River, near Defiance, Ohio, and a 60,000-volt transmission line running to Lima, Defiance and Toledo, did not suffer greatly in the floods, according to Mr. R. R. Livingston, Jr., New York, chief engineer of the company.

Part of the river bank back of the dam was washed away, but no other damage was done. The tailwater backed up considerably, causing loss of head and necessitating a temporary shut-down. While the plant was shut down service was secured from the steam plant of the Defiance Gas & Electric Company, but other places usually furnished by the Auglaize plant were not as fortunate. In the heavy windstorm of the week previous to the flood a few of the transmission towers of the Auglaize company were blown down. Altogether the properties withstood the troubles in a satisfactory manner.

DELAWARE, OHIO.—Water supply and electric service in Delaware were cut off on the night of March 24 and restored on the night of March 28.

EAST LIVERPOOL, OHIO.—From Thursday, March 27, until Saturday, March 29, the entire 60-mile trackage of the Tri-State Railway Company, East Liverpool, Ohio, was tied up on account of floods.

Traffic from Midland, Pa., to Wellsville, Ohio, a distance of 10 miles, was opened up on Saturday morning. By Monday evening, March 31, the line was opened to Steubenville, Ohio, a distance of 30 miles, and later on to Beaver, Pa., 26 miles further.

ELYRIA, OHIO.—The dam and plant of the Doherty company at Elyria were swept away, but as it had been planned previous to the flood to abandon this plant, the loss was immaterial.

FREMONT, OHIO.—Advices from Fremont, Ohio, dated March 31 are to the effect that the Schott Construction Company, which is building the Ballville hydroelectric plant, will suffer loss to the extent of about $200,000. This is possibly exaggerated.

MANSFIELD, OHIO.—High water got into the wheel pits of the Mansfield (Ohio) Railway, Light & Power Company, causing suspension of railway and lighting service from 2.30 a. m. on March 25 until 6 p. m. on March 28. The interurban track between Mansfield and Shelby was damaged to the extent of $500 to $1,000.

MASSILLON, OHIO.—At Massillon, where the Massillon Electric & Gas Company is located, service was interrupted for about three days.

One of the walls of the Massillon plant crumbled and part of the generating equipment was flooded. The damage was very slight and there was nothing but the drying out of equipment needed to restore service.

NEWARK, OHIO.—A letter received by the American Gas & Electric Company, New York, from H. L. Montgomery, manager of the Licking Light & Power Company, Newark, Ohio, one of its subsidiaries, describes conditions in that section as follows:

"We have just received a report from Mount Vernon that they think they will be able to start the plant some time to-day (March 27), as the water has dropped considerably and is out of the boiler room. As soon as they get the mud and rubbish cleared away, they will be able to start up.

"I understand all of the outside buildings in connection with the plant have been carried away, also all of the poles, and the coal pile is completely gone. We were fortunate enough to get a car of coal from the railroad company, and that will carry us along for a day or two. The water has not dropped sufficiently as yet so that we can find out whether any damage has been done to the building or not, but from what can be seen it is in very good shape. All railroad and wagon bridges have been washed out, and traffic is at a standstill.

"I understand two of our linemen narrowly escaped being drowned and were in the water for over two hours, holding on to one of our poles until they could be rescued. They are now in the hospital in a very serious condition. It will probably be a day or two before I shall be able to get to Mount Vernon.

"From what I can learn, it is the most disastrous flood the State of Ohio has ever known. The conditions at Newark are not serious, although the water has risen to a very high mark. It has done some little damage around our new plant, but nothing that cannot be repaired."

SANDUSKY, OHIO.—The overhead wires at Sandusky went down under a heavy load of sleet Thursday morning and both telephone and telegraphic communication was impossible. At that time the linemen were unable to say when service would be restored. The condition was such that the light plant could not furnish service.

TIFFIN, OHIO.—Mr. A. J. Bull, of the Ohio Light & Power Company, Tiffin, Ohio, an American Gas & Electric subsidiary, wrote to Mr. George N. Tidd, vice-president and general manager of the latter company, on March 29, as follows:

"Mr. Frank B. Espy (manager at Tiffin) has requested me to write you a report about the conditions here in Tiffin

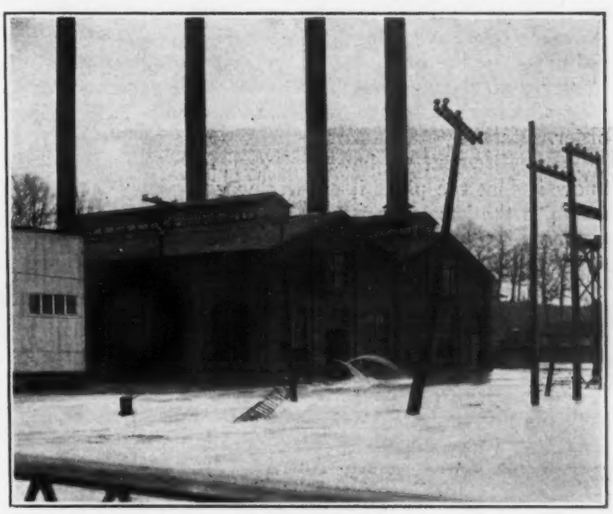


FIG. 2—PUMPING WATER FROM POWER HOUSE AFTER WATER HAD FALLEN 22 IN., MARION, IND.

since the flood. Mr. Espy has been busy all the time since the plant was flooded and has been working night and day in order to straighten out things. The water continued to rise until Wednesday night. It was then 3 in. or 4 in. above the engine-room floor. The water started to go down on Thursday morning, and by Friday morning it was down so far that we could get access to the back of the plant.

"Mr. Espy then got hold of a gasoline engine and pump and started to pump out the water from the boiler-room and engine-room basement. Last night the water had been pumped out of the plant. Fire was started under one of the boilers and we had steam up last night. Mr. Espy was, however, afraid to start up the engines yesterday and turn on the current because the distribution system was out of order. Very likely some of the wires in the damaged houses in the neighborhood are short-circuited and we should have risked starting fire in case the voltage had been turned on.

"In the old engine room apparently no harm has been done other than that the belts have been soaked with water and the splices of the belts as a consequence are rather unsafe. In the new engine room the generator of the McIntosh engine has been soaked with water and the armature will have to be dried out before the engine can be started. The old basement of the engine room is full of mud and will have to be cleaned out. The turbine generator can probably

be started up to-night. The water did not come high enough to spoil any of the apparatus in the switchboard, nor have any of the direct-current machines been touched by the water.

"The boiler room is full of mud and debris from outside. When the water started to run into the boiler room the two boilers on the west side were working. The cold weather has frozen up the coal pockets, but the ice will probably thaw as soon as the temperature rises in the boiler room. The coal-handling apparatus is intact. There was a large pile of coal in the back of the plant when the flood started, and about one-third of this coal has been washed away by the flood and the rest has been largely mixed with mud and gravel. The river has washed out the whole retaining wall around the pump house, but the pump house itself is not damaged. The whole alley from the plant and down to the pump house is still full of debris, and most of our poles in that neighborhood have been broken. All the crossings over the river have been broken and all poles in the neighborhood of the river banks are down. All connections to the damaged houses and to the section where the poles are broken have been cut off so that the direct-current system on this side of the river now is clear. It is very hard to say how many of the transformers have been lost. It will probably take some days before we can start the street lighting. In the office the water came up about 5 ft. In Fostoria no damage has been done. The plant was running all the time and the distribution system is in perfect order.

"From Fremont we have had very few reports. All we know is that the plant itself was working all the time, as was also the heating system. In the office the water came up about 7 ft. It is very probable that all the records have been lost. We have been trying to get telephone connection with Fremont to-day.

"In Tiffin very much damage has been done. About twenty private houses have been washed away by the flood. The water-works are out of commission. The gas supply is, however, intact on this side of the river. In the upper section of the town there was no interruption in the gas supply."

No damage was done to American Gas & Electric properties at Canton, Fremont, Fostoria or Logan.

Toledo, Ohio.—A letter reaching New York this week from Mr. H. S. Swift, secretary of the Toledo Railways & Light Company, outlined conditions in Toledo as follows:

"In so far as this company is concerned it has suffered no property loss by reason of high water. There has been no interruption to the service furnished the public by our transportation, electric, heating and artificial gas departments.

"For three days, however, our main power house on Water Street was completely surrounded by water to a depth of some 3 ft., which rendered the operation of our plant very difficult, and the result might have been serious had not our people bricked up windows and surrounded the machinery operated in the basement with brick walls to keep out the water. The use of powerful pumps enabled us to remove the water which leaked in.

"High water at our artificial gas plant made it necessary to abandon some of our retorts, and the retort house and coke-shed were flooded with water.

"Our operating expenses will be greatly increased on account of this flood, but we are thankful there has been no more serious result. Our only apprehension is that on account of the inability of the railroads entering from the coal fields to operate through service, we may be short of coal.

"Fortunately, we have enough coal in Toledo to operate for a number of days, and we trust that even if it is necessary to detour shipments our wants can be supplied before our stock is exhausted."

Troy, Ohio.—Newspapers listing the flood losses at Troy, Ohio, include the Hobert Electric Company and estimate the damage to this concern at $35,000.

Warren, Ohio.—Most of the damage to Doherty properties was done at Warren, Ohio. There the water rose to a height of 4 ft. on the floor of the generating room of the Trumbull Public Service Company, which operates in that city. On this account the plant was shut down for the night of Tuesday, March 25, until the afternoon of March 29.

At the plant of the Warren water company the filtration beds were wrecked and unfiltered water was being supplied to the city up to March 31. Advertisements calling attention to this and urging the public to boil their drinking water were placed in the local papers.

Service at the Warren gas plant was shut down in an unusual way. This plant is located on the Mahoning River just below a bridge of the Baltimore & Ohio Railroad Company. Under the pressure of the high water, this bridge finally gave way, but instead of going into the river was swung around and deposited directly in front of the gas plant, preventing access to it.

Youngstown, Ohio.—A man who arrived in Chicago on March 27 declared that Youngstown was under 8 ft. of water and that the Mahoning River had risen 10 ft. above any previous record. The electric lighting plant and the water-works were out of service, according to this informant.

Owing to its location on high ground, no serious damage was suffered by the plant at Youngstown. The boiler room was flooded, and after this had been pumped out service was restored. City fire engines were used to fill the boilers with water for starting.

Mr. Oren Root, president of the Republic Railway & Light Company, New York, issued the following statement to the stockholders on March 29:

"Mr. Norman McD. Crawford, president of the Mahoning & Shenango Railway & Light Company and other subsidiaries, states that the direct damage to the property will be less than $6,000; that no dams and only one small county bridge affecting the operations of the subsidiary companies have given way, and that practically the only loss will be from the interruption of the service for three or four days. Mr. Crawford states further that the property of none of our large power customers has been damaged, and that he is communicating with electrical manufacturers for prompt delivery of commercial motors to assist prospective power users whose plants have been badly damaged and who are requesting electric power installations."

Indiana

Indianapolis, Ind. (*By Telegraph*).—Electric light and power plants in Indianapolis did not suffer from the recent flood to anything like the degree that the telephone, telegraph and electric traction systems did.

None of the generating stations was submerged except those belonging to the Indianapolis Traction & Terminal Company. The traction company's generating station on West Washington Street, which was the first to be put in service after the recession of the flood, supplemented by outside interurban stations, furnished enough energy to keep a large percentage of the street cars in operation. Generating stations owned by the lighting companies were more fortunate in being located on higher ground and out of reach of the river.

Business districts and the greater portion of the residence districts were unaffected by the flood, except in being deprived of the normal water pressure and outside communication.

About ten electrically operated wells in various parts of the city, owned by the Indianapolis Water Company, were put out of commission by the motors being submerged. The Merchants' Light & Heat Company came in at the opportune moment and connected a large centrifugal boiler-

feed pump with the city's water mains and supplied about 2,500,000 gal. per day for use in case of emergency for fires and flushing purposes.

Most of the damage done by the flood in the immediate vicinity of Indianapolis was on the North and West Sides. Practically all of the railroad bridges at Indianapolis were carried away except the Big Four bridge and the Pennsylvania Railroad bridge across the White River. Telephone and telegraph cables were severed in practically every place where the bridge was demolished.

It is remarkable that the eighteen or twenty heavy railway feeders supported on poles on the West Washington Street bridge over the White River were left unsevered although the poles were carried away when the bridge was demolished. This handsome arch bridge, which was of massive stone construction, was built recently. Telephone and telegraph cables which were run through conduits in this bridge were totally destroyed.

Re-establishment of telephonic communication across the river was accomplished by a rather novel method as the swift current and width of the river at this point would not permit crossing in a boat. A line was carried across the river by means of a kite and the messenger for supporting the cable pulled across in turn and anchored on each bank. Fig. 5 shows one of the Central Union Telephone Company's employees hooking the cable to the messenger. As the location of the temporary cable will interfere with the reconstruction of the bridge, it will be moved about 25 yd. to one side and supported from each bank by a frame. A permanent cable will not be installed until the bridge is reconstructed, as it will have to be inclosed in conduit in the bridge proper.

Mr. T. A. Wynne, vice-president and treasurer of the Indianapolis Light & Heat Company, said that the losses sustained by the company due to the flood would probably not exceed $1,000, excluding the loss of revenue due to the output dropping to about 50 per cent of normal during the worst part of the flood.

At present the load is about 80 per cent of normal and only awaits the rehabilitation of the flooded district to assume standard conditions. This company supplies electrical energy to factories and suburbs and furnishes considerable lighting. About one-half mile of its 4100-volt transmission line running to the Prest-O-Lite Company was torn down on the West Side of the city. It is asserted that this damage was caused by the traction company's heavy feeder line falling and uprooting poles on a curve. Line drops to houses were removed by the flood in several cases, but these will not be repaired until the houses are ready for occupancy. Except for short periods when permanent grounds occurred and circuit-breakers were blown, electricity was supplied to all who could use it during the flood.

Thomas Cusack & Company said that their electric signs, aggregating 1239 in number, were not extinguished during the entire period of the flood except a small lighted bulletin and a cigarette company's sign which were blown over by the recent cyclone. The cigarette company's sign contained about 3000 lamps and was about 45 ft. sq. Its failure during the cyclone is laid to faulty anchorage.

Among the large electrically driven factories along the banks of the White River which were submerged during the flood and unable to operate were those of the Nordyke & Marmon Company, Willys Overland Company, R. J. Irwin Company, Parry Manufacturing Company, Motor Car Manufacturing Company, the Marion Sales Company and the National Starch Manufacturing Company.

These concerns ranged from 100 hp to 500 hp in motor loads. The first six companies were supplied with electricity from central stations in Indianapolis and the latter had an isolated generating plant. The actual extent of the damage done in each case cannot be ascertained until the water recedes.

Although the Kentucky Avenue bridge across the White River was demolished, the Merchants' Light & Heat Company's main leads were not affected at this point as they were not supported on the bridge, but were anchored on heavy poles on each bank.

These poles were on high ground and not reached by the flood. For similar reasons the main leads across the river at the north of the city were unharmed.

About eight poles supporting the transmission line which supplied the Marion Sales Company with electricity were washed out on the levee, but another line was run in from the north immediately. Water is still in the engine room of this building. Water breaking through the levee to the north of the city broke several poles on a small transmission line supplying energy to Broad Ripple, a suburb of Indianapolis, causing a short-circuit and burning out the line.

The isolated generating plant at the Claypoole Hotel in Indianapolis was put out of service because it was impossible to get water for boiler feed. The Merchants' Light & Heat Company supplied electricity to this hotel as well as to the traction terminal building during the flood.

Service might have been interrupted at the Merchants' Light & Heat Company had it not been for an electrically driven centrifugal pump which emptied the basement of the

FIG. 3—CABLE AND CONDUIT AFTER FLOOD—ROADWAY BRIDGE, INDIANAPOLIS

generating station of the water which backed up through the sewers. The sewers were later closed up.

Instead of the output of the People's Light & Heat Company decreasing during the flood period it was increased to a slight extent on account of the contract for lighting the Coliseum during the Auto Exhibit March 31-April 5.

The Indianapolis abattoir which was being equipped with about sixty Westinghouse motors aggregating 300 hp for packing purposes, was submerged in 7 ft. of water. About 75 per cent of the work was finished when the flood came.

Four Western Union cables supported from angle-iron braces on buildings at each end of the Kingan bridge across the White River at Indianapolis were cut to prevent the buildings from being pulled down when the bridge went out. These were replaced by temporary cables running across an adjoining bridge which withstood the flood.

A telegraph office at Alexandria, Ind., was burned as a result of a "cross" with a 60,000-volt line. At Logansport the water was 5 ft. deep in the office. Counters and furniture floated away. The circuits with this city were lost for three days.

Mr. A. C. Cronkhite, district commercial superintendent of the Western Union Telegraph Company, said that the wild reports which spread around the country concerning conditions at Indianapolis caused a tremendous congestion in telegraph traffic.

A commissary train was sent out of Richmond on March 27, in charge of Mr. S. V. King, of the *Commercial Age*, Indianapolis, to take care of operators in Dayton and vicinity.

Conditions similar to those mentioned above were experienced by the Postal Telegraph Cable Company. Pole lines were down in practically every direction. About 500 poles were down between Columbus and Seymour, Ind. Twelve poles were carried away at Terre Haute by the Wabash River, but in eighteen hours, with the help of two motor boats, the circuit was re-established. It is asserted that 75 per cent of the telegraph service has been restored.

Considering the extent of the damage, the conditions under which repairs have been made and the short time that has elapsed, the progress made toward restoration is to be commended. Construction men employed by the Central Union Telephone Company were scattered all over Indiana, preparing for spring extensions and reconstructions, when the flood overspread the State. Mr. W. R. Hirst, plant superintendent at Indianapolis, concentrated his efforts and succeeded in getting practically all of the men back in forty-eight hours.

On March 26 the exchanges on the North and West Sides of the city were put out of commission, making about 6000 stations idle in Indianapolis. In five days all except 600 of these stations were again in service. Drinking water was pumped from a well located in the Central Union Telephone building by electricity and distributed to employees by automobiles during the flood.

According to reports made by the Central Union Telephone Company of Indiana, the following equipment was lost or destroyed in the State of Indiana because of floods: 500 poles, 15,000 ft. underground cable, 10,000 ft. aerial cable, 8000 ft. underground duct and 100 miles toll circuits. It is estimated that temporary repairs in the State of Indiana for damage done by flood will amount to $50,000, and an additional $100,000 will be required to make repairs permanent.

General Manager Moriarty of the Indianapolis Telephone Company should be especially congratulated on the progress made by the independent telephone system in re-establishing service in Indiana.

About 3000 independent stations were out of commission in Indianapolis and two-thirds of these were in service again in three days. Cable had to be shipped in from Chicago and men were recruited from various places, while some came in and offered their services. Mr. William Fortune, president of this company, said that by April 1 80 per cent of toll service would be restored.

Mr. Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company, sent the following letter to the *Electrical World:*

"Newspaper reports were generally very much exaggerated in regard to the flood damages in Indianapolis. The water was 6 ft. higher than ever before recorded, but there have been only five deaths. All the public-service corporations were damaged to some extent. The street-car company and water company were both out of service for four days and are now only partially operating. The Indianapolis Gas Company was out of service for one day. All three of these stations were under from 6 ft. to 10 ft. of water. Both telephone companies were practically out of business. The Indianapolis Light & Heat Company, however, was able to maintain its service intact with the exception of one unimportant line. The water was really about 12 ft. above our station floors at both our generating stations, but owing to strenuous efforts we managed to keep the water out of our stations and they were not particularly damaged.

"The street-car company has had some of its electrical apparatus submerged, but the damage will consist merely in drying and getting ready for service. It also lost all of the cables leading away from its generating station, the carrying lines having been torn down by the flood, the poles nearly all broken and cable being down along the various rights-of-way. This cable, however, can be reinstalled on new poles.

"The water company's loss will consist largely in cleaning its station and drying out its electric motors, quite a number of which were submerged, and repairing its canal banks and river dikes. Its loss will be perhaps $100,000 The Indianapolis Light & Heat Company was supplying energy to the motors above specified, which were operating pumps for considerable of the water supply. The station and line loss will be insignificant. Perhaps the greatest loss sustained by any of these companies will be from lack of returns occasioned by the shut-down.

"The Indianapolis Light & Heat Company's output was materially reduced by reason of the fact that a large number of its customers were shut down in the manufacturing district, our output running about 50 per cent of normal during two days of the high water. It is now up to 75 per cent of normal, this being the seventh day from the beginning of the flood. We will probably not reach our normal output for another week."

Marooned in Indianapolis by weather disturbances and floods the executive heads of H. M. Byllesby & Company, of Chicago, were unable for a time to make their whereabouts known, and much anxiety concerning them was felt. A party composed of Messrs. H. M. Byllesby, president of the Chicago company; John J. O'Brien, its first vice-president, and Fred Stearns, the Byllesby general counsel, left for Louisville on the first night of the storm and were compelled to seek refuge in Indianapolis. That city was subsequently cut off from communication with the outside world and for forty-eight hours it was feared that these men had met with some mishap, although subsequently messages regarding their safety in Indianapolis were received.

Elwood, Ind.—N. M. Argabrite, manager of the Indiana General Service Company, Elwood, an American Gas & Electric property, wrote on March 31 to the *Electrical World* as follows:

"The water backed up on the electric-lighting properties until it was within 4 in. of our fires. It came in on our pump-room floor and also in our substation nearly 2 ft. on the high-tension transformers. It came into our engine room, entirely filling our pump pits and condenser pits, and came faster than we could pump it out.

"In spite of this the Elwood electric-light plant gave continuous service throughout the entire period. It might be interesting to state that the three plants in Indiana belonging to the American Gas & Electric Company, supplying energy to Muncie, Eaton, Hartford City, Dunkirk, Redkey, Jonesboro, Upland, Gas City, Marion, Fairmount, Alexandria and Elwood, were practically the only three plants of any importance in this section of Indiana which continued to give service under the adverse circumstances."

Fort Wayne, Ind.—Owing to the high water the municipal electric-lighting plant at Fort Wayne was shut down on parts of several days. The city water-works were also compelled to discontinue operations, but by building a cofferdam at Station No. 1 and pumping the water out an electric motor-driven pump was enabled to give partial service.

Kokomo, Ind.—While newspaper reports of damage done to the properties of the Indiana Railways & Light Company at Kokomo, Marion and other points were much exaggerated, according to Mr. T. C. McReynolds, secretary-treasurer, interruption to service resulted from the Kokomo power plant being out of commission from noon March 24 to the afternoon of March 29. No great damage was caused, however, except the inconvenience to the company's patrons. Between Marion and Kokomo the interurban cars operated during most of the flood week. One small washout occurred on the railway right-of-way.

Logansport, Ind.—A. C. Parsons, resident agent of the

General Electric Company at Logansport, Ind., reported to the Chicago office of the company on March 25 as follows: "I am marooned here. Wabash and Eel Rivers both over their banks. Business part of town flooded as far back as Fourth Street from First Street the whole width of the city. City Hall, where electric light office is, under water. Pennsylvania, and I think Wabash, depots both under water. No trains in or out. No traction service. Water is rising, with promise of more rain. Don't know when I shall be able to leave Logansport. Wrecks in every direction."

MARION, IND.—Mr. O. M. Dreschel, manager of the Marion Light & Heating Company, wrote on March 29 to the American Gas & Electric Company, New York, as follows:

"On Monday, March 24, we began to have trouble with high waters in this section and we are just beginning to be relieved. One can hardly realize how we managed to keep the Marion plant from going under water.

"Tuesday morning at 1:30 the water was 22 in. high on our turbine-room floor. All of the boiler-room was under water, which rose to an inch of our fire boxes. We had to bank our fires and close down everything with the exception of the spare circuit (supplying the business district), keeping on just enough power to give us light so as to operate the pumps that were removing the water from the pit in the turbine basement.

"Some of the men were on duty sixty to seventy hours. Otherwise we should have gone down and out, and the damage that would have been done cannot be estimated, not only in our own losses but in the loss to the factory people.

"We thought Monday evening that we had the high-water mark and did not believe it possible for the water to get any higher at that time, it being just even with the turbine floor. By operating three of the pumps in the basement we were able to hold our own, but from this time on the water began to rise and, as above stated, reached 22 in. above our main floors. We built cofferdams around the openings leading into the boiler room, but with the three pumps we could not hold our own and lost ground.

"As the last means we broke the 'L' on a No. 4 circulating pump and made a connection for a 4-in. pipe discharge in the handhole of the condenser, and with this outfit in operation we were able to keep the water at a standstill and thereby save the Marion plant.

"About 1:30 Tuesday morning, when the water was at its highest, the south wall of the basement began to leak and water was soon pouring in at the rate of 500 or 600 gal. a minute. Two of the men, with their arms, succeeded in keeping this back until the hole was plugged with rags and clay. About this time the firemen reported that the water was reaching their fires and that the drafts were entirely covered. We thought that within the next fifteen minutes we should be entirely at the mercy of the water. We banked the fires and opened the fire doors, receiving what little draft was possible through them, and by operating only the square circuit with what auxiliaries we had in the plant we were able to run in this condition until about 2:30, when the water reached its maximum.

"At 3 o'clock the water had begun to fall about ⅛ in., and we knew if we could hold out much longer the victory was ours.

"By 6 o'clock Wednesday morning we had about 2 in. of draft under our boilers, and we then gained ground. The river began to fall very rapidly, and by Wednesday night only 6 in. of water covered the boiler-room floors.

"To make matters worse about midnight on Tuesday the transmission line in Johntown went down, the water having excavated the dirt around the poles and left them hanging by the wire. This cut off any chances of receiving aid from Muncie.

"The Marion, Bluffton & Eastern Traction Company's transmission line went out about 2 o'clock Tuesday morning, several of the houses in Johntown having washed against the poles, tearing them down."

Managers of the Standard Glass Company and the Standard Chain Company, both of which are large customers of the Marion Light & Heating Company, visited the plant of the lighting company during the flood and wrote to the president of the American Gas & Electric Company warmly commending the loyalty of the Marion employees from the manager down.

MUNCIE, IND.—A letter received by the American Gas & Electric Company, New York, from L. B. Webster, of the Muncie (Ind.) Electric Light Company, told some of the troubles experienced there as follows:

"The White River at Muncie was 3 ft. and the Missinewa at Marion was 4 ft. higher than any previous high-water record. Both the Marion and the Muncie plants were so seriously threatened that at the time of the crest of the flood it appeared impossible to keep the water out of the plants. That the water was kept out and serious damage prevented was due entirely to the perseverance and loyalty of all men in both organizations. At Muncie men worked for hours wet to the skin, and at Marion some of the men worked over forty-eight hours without rest.

"In the whole flooded district in Indiana, including Indianapolis, the Marion and Muncie plants were the only ones operated continuously and had current on the wires at all times.

"At Muncie the water-works were shut down and the only drinking water in the city was furnished by the hotel wells operated by electric pumps with our service.

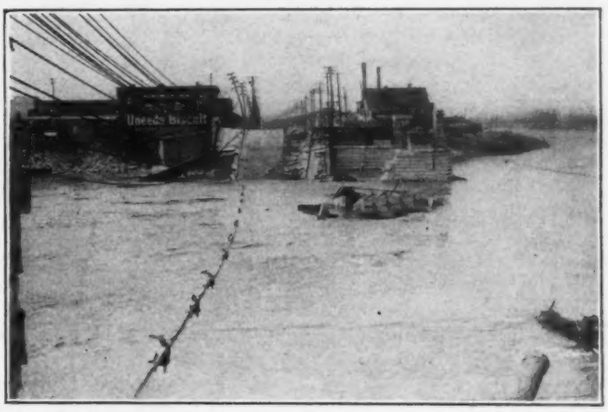


FIG. 4—STREET-RAILWAY FEEDERS UNTOUCHED BY FLOOD

"We made every effort possible at Jonesboro to save that plant, men working in water up to their waists trying to raise the motors and transformers to keep them out of water, but it was impossible, and we had to abandon it Tuesday at midnight. However, the water did not get into our high-tension transformers and the light service has been re-established at Jonesboro.

"The plant went under 5 ft. of water, entirely covering the motor-driven pumps and all apparatus with the exception of the high-tension transformers.

"All our transmission lines, with the exception of the one between Marion and Hartford City, are in comparatively bad shape, and I personally believe that we must practically rebuild the line between Jonesboro and Alexandria. The weight of the wishbone cross-arm, together with the wires, is entirely too much for this size of pole, and from the high winds and water-soaked ground these lines have in some places gone over 8 ft. to 10 ft. We have temporary guys on them in such places, and I do not believe there is a pole standing straight on the line.

"Before these repairs are undertaken I think that, if possible, this line should be thoroughly investigated and either replaced with steel towers or else shorter spaced poles should be planted. I do not believe our loss will exceed

$1,500, not including the loss of revenue from the factories being shut down or repairs of the Jonesboro property and the tie lines.

"The flood was due to almost seventy-two hours of very heavy and continuous rainfall which began on Saturday, March 22, and ended Wednesday, March 26, with 6 in. of snow. On Tuesday, the worst day, the water was well over the top of the Muncie forebay, which we protected with a cofferdam of sand bags. At one time the water was 2 ft. deep in the turbine pit at Muncie.

"The switch cells were protected by a cofferdam built around them. The oil-pressure pumps, make-up pumps and hot-well pumps were operated under water.

"The actual damage at these two plants will be small, being merely the cost of material and extra labor needed to fight off the water and to care for minor line and forebay repairs. At Jonesboro the motors driving the waterworks pumps were soaked and will have to be dried out. When the flood came the motors were disconnected and raised, but not high enough to be entirely above the water."

RICHMOND, IND.—J. B. Wharton, manager of the Richmond (Ind.) Light, Heat & Power Company, wrote to the *Electrical World* March 31, in response to an inquiry as to flood damage:

"The actual damage has probably been somewhat exaggerated, but conditions are extremely bad. Our electric plant was flooded, the dam in the river for intake water was washed away, our smokestack blown out of position and a part of the city was flooded.

"Railroads are at a standstill in every direction on account of the bridges being washed out, and there is grave danger of running out of supplies of all kinds, especially coal, oil, etc. We are in good condition as far as foodstuffs are concerned on account of our agricultural surroundings. The municipal electric-light plant was also flooded and somewhat damaged, but at present is running non-condensing."

TERRE HAUTE, IND.—T. F. Grover, general manager of the Terre Haute, Indianapolis & Eastern Traction Company, in response to a request from the *Electrical World* for information, sent this statement dated March 28:

"The cyclone, which struck Terre Haute at 9:30 p. m. Sunday, March 23, swept a strip about one-fourth of a mile wide in the southern part of the city between Hulman Street and Helen Avenue, leveling all buildings, poles and wires for the entire width of the city east and west. This included our Greenwood transformer station, which steps up the emf from 2300 to 23,000 volts, supplying energy for our Sullivan line. The brick station was wrecked and the cyclone was so strong that it even moved the 500-kw transformers from their foundations.

"In addition to this all our service wires and poles for a section of 2½ miles of the city got in such bad condition that it was necessary for us to cut all wires from the beginning of this section, which was quickly done. Our city service north of this section was put in operating condition on Monday, although we experienced a raging storm during all of this time. The storm caused the Wabash River to go on a rampage, and the floods have done us much damage—to just what extent we are unable as yet to state, as the river is still 31 ft. above low-water mark. We are unable to get out of Terre Haute on our Paris line, or to know the extent of our damage, although we know that we have about 3 miles of high-tension line down.

"The traction line, as well as the Big Four and Vandalia railroads, is entirely flooded out for about 2 miles in this district. On our Clinton line we have about 3 miles of track under water and cannot tell the extent of the damage until the water lowers. We do not know the entire damage on our Sullivan line, as we are unable to get through as yet, but so far as we can ascertain we have about a mile of track washed out.

"Our most serious condition has been at our power house, where the water has risen 6 ft. beyond any record ever known for the Wabash, and while we now have our power plant in operation, we have saved the day so far by building brick walls and walls with thousands of bags of sand surrounding the power house. Although the water is nearly 3 ft. higher than the doors in our engine room, we are able to keep the water out, and so far no electrical machinery has been damaged. We have accomplished this by shutting down our plant for about fourteen hours and using our circulating pumps for throwing out the immense volume of water that was coming in on us. We feel at this time that we are going to save our power house, but of course cannot be sure until the water falls, as the pressure on our walls is terrific and we have some very bad leaks."

AMERICAN GAS & ELECTRIC PROPERTIES HAD MUCH TROUBLE BUT SLIGHT LOSS

Reports of conditions at the Indiana, Ohio and West Virginia plants of the American Gas & Electric Company, sent by the local managers of the public utilities in those States to Mr. George N. Tidd, vice-president and general manager of that company, show that while unprecedented conditions existed at these properties during last week's floods, the perseverance, loyalty and resourcefulness of the operating staffs kept the total property loss down to about $5,000.

From the local managers and from customers of the companies, warm tributes to the faithfulness of the men have been received by Mr. Tidd, who, when seen this week by a representative of the *Electrical World,* was most enthusiastic over the splendid work done by the men.

Before the floods reached Muncie a heavy windstorm struck that city on the night of March 20, which toward morning gained the proportions of a cyclone. Some of the mast-arms on the Dunkirk line were torn down by the wind, the line between Hartford and Jonesboro was torn down and some of the poles between Muncie and Hartford were also heeled over badly.

Hardly had these difficulties been overcome when the floods broke upon the section.

MIDDLE WEST UTILITIES PROPERTIES IN INDIANA

Inquiry at the office of the Middle West Utilities Company in Chicago on March 27 revealed the fact that no word had been received from the subsidiary companies in central and southern Indiana since March 24. The Middle West company serves sixteen communities in Indiana with electrical energy and controls two interurban railways and three street railways in that State. On the date last mentioned the interurbans were practically tied up, but the bridges were standing and no track has been washed out as far as known.

Later news was contained in the following cablegram sent on March 28 by Mr. Samuel Insull, president of the company, in response to inquiries from London, Amsterdam and Geneva: "No Middle West Utilities properties in territory where greatest flood damage occurred. Our interurban road from Indianapolis south only temporarily affected. Now operating about half mileage. Expect to operate remainder within a few days. Delay caused by about 2 miles of track damaged by flood. Only one small girder bridge over culvert damaged. Very nominal damage to any of our power stations and transmission lines. Cannot yet determine exact property loss, but feel from reports received it will be small."

Kentucky

LOUISVILLE, KY.—The flood in the Ohio River at the falls where Louisville, Ky., is located, inundated the entire lower floor of the old generating station of the Louisville Lighting Company at the foot of Tenth Street but caused little damage aside from flooding a quantity of machinery at that level. The station is now using only a 150-kw generating set which is on the second floor and hence

suffered little from the immersion. It is not believed that the rising waters will affect the big station of the Kentucky Electric Company, which is located directly on the river front, as this structure was erected with the view of avoiding all possible floods, even one above the mark of the unprecedented one of 1884.

During the violent windstorms which preceded the torrential rains of March 24, 25 and 26 in the Ohio Valley a large steel stack in the plant of the Campbell Electric Company, which is owned by the Louisville Lighting Company, was blown down, and in repairing the damage the combined crews of the Louisville Lighting Company and the Louisville Home Telephone Company effected one of the quickest pieces of work on record. The stack, in falling, destroyed one of the most important cables of the telephone company, but within two hours after the accident the damage done was completely repaired, the debris of the shattered stack removed and a new cable had been strung through 1500 ft. of alleyway at the point.

Missouri

BRANSON, MO.—Although water poured at a height of 6 ft. over its crest, the dam of the Ozark Water & Power Company, on the White River, near Branson, recently closed, was not affected.

New York

In Albany, Schenectady, Troy and many of the other cities in the upper part of New York State electric service was interrupted to some extent owing to high water last week. It was first thought that the new State Barge Canal had been greatly damaged, but it was found later that this had withstood the flood in a satisfactory manner.

State Engineer Bensel said March 31, at Albany: "Along the Mohawk, upper Hudson and other streams which connect with the canals of the State the waters are receding rapidly and conditions are now at a normal point. I have been in close touch with canal officials at Fort Edward, Yosts, Amsterdam, Waterford and other places which have been seriously affected by the floods, and they report that unless something unforeseen occurs there will be no further damage of moment done along the line of the old and new canals.

"Terminal Engineer John A. O'Connor, who has been on the western division of the canals for a week, returned today and reports that while barge canal construction work has been under water, in his opinion no great amount of damage has been done to the permanent work and all the structures are in safe condition."

AUBURN, N. Y.—A telegram to the *Electrical World* from the Empire Gas & Electric Company, Auburn, states that the flood conditions did not interfere with that company's plants.

TROY, N. Y.—In a telegram from the Troy Gas Company, which supplies electric service in that city, it was stated that the service was interrupted from Thursday to Monday. The water reached the line shafting and caused damage estimated at $15,000, exclusive of the loss in revenue. On April 2 all alternating-current circuits were in operation, while seventy-four direct-current customers were still without service.

ALBANY, N. Y.—Mr. A. Anderson, general manager of the Municipal Gas Company, the electrical department of which furnishes electrical energy to Albany, sent the following statement to the *Electrical World* in response to a request for information:

"The flood did not do any damage to our equipment beyond washing away a couple of poles on our street circuit near the river. Our great difficulty was on account of the water-power stations from which we buy energy being put completely out of commission. The Adirondack Power Corporation furnishes us with all of the power which we use from its station at Spier Falls and another at Mechanicsville. The Delaware & Hudson Railway Company has a steam station at Mechanicsville which is supposed to help out the Adirondack company in case of an emergency, but all three of these plants were inundated and completely out of commission so that we had to start our steam reserve and operate from our own station.

"This was a rather difficult problem on account of the steam plant not having been used for about nine years. We had three 500-hp boilers under steam at the time in case of an emergency. These picked up some of the load within a few minutes after interruption of the power company's service. Our men immediately proceeded to fire up the other boilers which had the manhole covers off and had not been used for nine years. In four or five hours these boilers were in commission and that night everything was running in Albany as usual. The company carries a few firemen and engineers as a nucleus of a force for the engine room so that in a case of this kind they can instruct the green men. The scheme worked to perfection and we had no trouble in taking care of our business.

"On Saturday afternoon the Adirondack Power Corporation furnished some energy to us from another source and, with our own steam equipment and what we got from them, we are operating satisfactorily now. Our underground system, which had just been put in commission in the flooded district, was completely submerged and the only

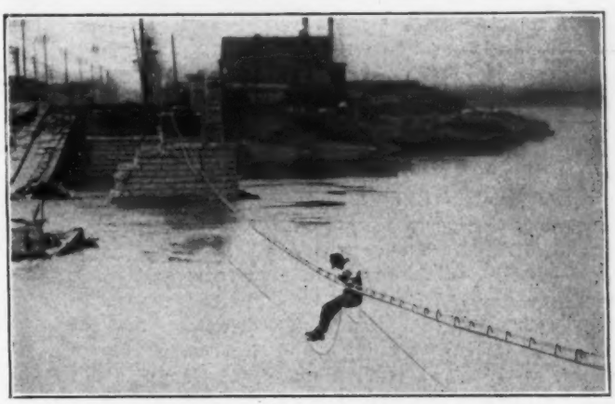


FIG. 5—LINEMAN INSTALLING TELEPHONE CABLE ACROSS WHITE RIVER AT INDIANAPOLIS

damage that we had was the loss of a few meters. All the underground equipment worked satisfactorily; transformers, junction boxes, fuse boxes and cables which were completely submerged for three days never gave us the least bit of trouble.

"In spite of the flood coming on us so suddenly, the newspapers were all able to get out their editions on time, which was about two hours after the shut-down occurred. Some of the Troy newspapers were printed in Albany, as the Troy people were in greater difficulties than we were. The first thing we did was to see that the newspapers had proper facilities for printing their papers so that we could keep the public informed on what was best for them to do."

The electric-light service in Troy was turned on on the evening of March 31, and many factories resumed operations on that day.

NEW YORK, N. Y.—Representatives of Henry L. Doherty & Company said this week that the total loss to their properties from flood damage will not exceed $15,000. This does not include loss of revenue from interruption of service.

Representatives of the Henry L. Doherty Company expressed confidence that newspaper reports of damages to public-utility properties will be found to have been greatly exaggerated when all of the facts become known.

SCHENECTADY, N. Y.—Mr. Henry W. Peck, general manager of the Schenectady (N. Y.) Illuminating Company,

sent the following to the *Electrical World* in answer to a request for information regarding the extent of damage to that company's property:

"The flood in Schenectady reached practically the same height as the October flood of 1903, in some places measuring half an inch lower and other places slightly higher. The Schenectady Illuminating Company receives its energy from water-power stations at Schaghticoke and Johnsonville. Neither of these plants was in any way interfered with by the water; in fact, on Saturday connection was made from these plants to the line of the Adirondack Electric Power Company, and surplus energy was supplied to Albany and Troy.

"The steam station reserve in Schenectady, which is surrounded by a dike, was unaffected by the high water. The basement of the substation supplying the commercial circuits about Schenectady was 5 ft. above the high water. The offices of the operating department escaped by an inch, but the storeroom floor was covered with 10 in. of muddy water, backed up through the old bed of Cowhorn Creek, which has been transformed into a drainage sewer.

"The gas works of this company very narrowly avoided a shut-down. Dams made of bags of concrete across the doorways of the boiler, engine and governor houses kept these important rooms dry against 12 in. of water outside. The water-gas generator room and almost the entire yard were submerged, but aside from decreasing the candlepower and losing the tar, no great damage was done. The total expense incurred will not exceed $100."

Rochester, N. Y.—The Genesee River reached its maximum height at Rochester, N. Y., on March 28, the water covering the business section of the city for about a mile to a depth of from 3 ft. to 4 ft. above the streets. That section of Rochester is served entirely by the three-wire direct-current system of the Rochester Railway & Light Company, and it is a remarkable fact that although the underground conduits, services, service boxes and meters were entirely submerged for a period varying from twelve to thirty-six hours, there were only two interruptions to services out of approximately 250 customers that the company has in that section. The services and meters, of course, were not water-tight and were actually alive, energy flowing through them for this length of time.

The company kept the mains alive, however, as investigation did not show any appreciable loss. In fact, the output from the stations on the Edison system during those two days dropped off quite considerably. In one case—a large hotel which receives its energy from the central station and which has an electric switch of 3000-amp rating—the hostelry continued to receive energy for its lamps and motors, although the service was entirely under water, without any visible difference in the quality of the light.

After the flood subsided, inspection of services and meters in the flooded district showed that severe electrolytic action had taken place and that the wires, plugs, etc., were in many cases just on the verge of being eaten away by the action. Undoubtedly had the flood continued several hours longer some of the places in the flooded district would have been without electricity. The street lamps in the business section are also fed from the Edison system, and it was necessary to go in a boat from post to post for two nights in order to switch them into circuit. It was truly an interesting sight to see these street lamps rising from the water and the buildings on either side illuminated, showing the busy workers moving their goods and protecting their property.

Mr. Thomas Yawger, superintendent of the Rochester Railway & Light Company, said that the company did not have a single short-circuit on the entire Edison system during the flood period that was of sufficient magnitude to be perceptible in any of the stations of the company. Two small low-head water-power developments on the Genesee and forming part of the Rochester Railway & Light Company's generating system could not be operated during the flood-water period, but beyond this the damage to the meters and service boxes and also to gas meters will not exceed $10,000. When the water had reached the furnaces in the different establishments there was an immediate demand for gas and electric heaters. The company had a very small number of heaters on hand, but such as it had were soon put to work. It is estimated that if the stock had comprised 1000 kw in heaters these could have been installed temporarily during the few days of the flood, and inasmuch as the meters were not registering, would have added to the comfort of the company's customers in more ways than one. The company's garage was in the flooded district.

When the vehicles attempted to return to it on the evening of March 27 they were unable to enter because of the water. The company knew that it would need the wagons the next day and that they would have to be charged, so a temporary line was run over some buildings on to a street which was high and dry and the electric vehicles were backed up to the curb and charged from this temporary connection.

H. M. Byllesby's View of Flood Damage

Mr. H. M. Byllesby wired the following to a New York newspaper on April 1:

"The Middle West has marvelous recuperative powers. The flooded districts and cities of Ohio and Indiana may be depended upon to rehabilitate themselves quickly and efficiently. Estimates of damage to property will be found greatly exaggerated. It cannot be denied, however, that serious injury has been experienced and that electric light and power, gas and telephone properties have suffered, together with other forms of privately and corporately owned property.

"The losses that have been incurred by public utilities emphasize one great advantage of syndicate control and management. It is safe to say that every company so held will be rehabilitated without difficulty, delay or embarrassment in securing the necessary funds. A large holding corporation operating properties over a wide area cannot be vitally injured by great disasters in one or two, or even three, states.

"H. M. Byllesby & Company operate no utilities in Ohio or Indiana, and it does not appear that any damage or loss of consequence is imminent at Louisville. The recent floods should concentrate the mind of the nation upon the necessity of broad measures to prevent such calamities.

"The government, the states and the public-utility companies, by co-operative effort, may not only store, conserve and control the supply of streams, but in so doing develop great amounts of hydroelectric power to be used for lighting and power. This work will be of the greatest magnitude and importance, and will call for the best the United States can produce from statesmen, capitalists and engineers."

Chicago Contributions to Flood Sufferers

Chicago, Ill.—The Chicago Association of Commerce pledged $100,000, and actually raised a much larger sum for the flood sufferers. Among the contributors to this fund were the Commonwealth Edison Company, which gave $5,000, and the Chicago Telephone Company, which subscribed $2,000. The Middle West Utilities Company gave $500, the Central Electric Company $500 and Mr. Samuel Insull $500. A large number of electrical manufacturers, dealers and engineers in Chicago contributed to the relief fund, which by March 29 had reached over $200,000 and was growing rapidly.

Subscriptions amounting to $1,000 were raised in two days by the telephone operators of the Chicago Telephone Company for the relief of their sister operators in the flooded district of Ohio. As about 5000 operators will probably contribute to the fund, the total may be swelled to double or triple the amount named. It is the intention to get in communication with Mr. F. W. Whitten, traffic superintendent of the State of Ohio, and ascertain the condition of the girls in that State.

Pennsylvania Electrification Plans

Although no official information has been forthcoming regarding the details of the plans of the Pennsylvania Railroad Company to electrify its main line from Philadelphia to Paoli, the *Electrical World* is unofficially informed that alternating current will be used and that the company will buy energy locally, at least for the next few years. The announcement of March 13 regarding the Philadelphia-Paoli electrification stated that the improvement would involve an expenditure of $4,000,000 and would be completed in 1914. It was assumed that the company's plans included the erection of its own power house, but this is an ultimate rather than an immediate probability.

The next steps in Pennsylvania electrification cannot be stated with official exactness, but it may be prophesied that electrification of the Baltimore terminal and tunnel will follow the completion of the Philadelphia work, and that with the electrification of the Washington (D. C.) terminal next in order, the linking up of Washington, Baltimore and Philadelphia by electrified line will not be long delayed.

Expert Aid in Wireless Rescue

Owing to the practical and timely assistance of Mr. Axel H. Geermann, a Danish electrical engineer in the Mexican government service, who was a passenger on the steamship *Texas*, which was disabled in midocean on March 20, a greater disaster was prevented, or at least the passengers on this ship were saved the experience of drifting for an indefinite time in extremely rough weather in a disabled 4000-ton steamer. From the time the steamer left Stavanger, Norway, on the way to Vera Cruz, Mexico, it had to battle with the high sea, and on the eighteenth day the waves knocked off the propeller and disabled the steering mechanism and the wireless apparatus. The two young wireless operators were ignorant of the construction of the apparatus and unable to repair it. Mr. Geermann, who has had much experience in the wireless telegraph field and has built several wireless stations for the Mexican government, among others those at Guaymas, Islas Marias, Vera Cruz and Payo Obispo, was able to assemble and restore the apparatus so that thirty-eight hours later he could get into communication with the *C. F. Tietgen*, of the Scandinavian-American Line. At that time the steamer was 1900 miles east of Sandy Hook. By noon the following day the *C. F. Tietgen* reached the *Texas* and succeeded in transferring the passengers by small boats in a very rough sea without any accident.

Electrical Development Society Offers $200 for "Slogan" and Trade-Mark

The Society for Electrical Development, Inc., has offered $200 in cash prizes for a "slogan" and trade-mark to be used in its advertising and other literature. The offer is made in two parts, $100 for the best slogan and $100 for the best trade-mark. Competition will close May 5, when the award will be made by the executive committee. It is the aim of Mr. J. M. Wakeman, general manager of the society, to interest all persons in the industry in this competition, focusing their attention on the society, its aims and its possibilities. Contestants should mark their contributions, "Slogun Contest," and address them to the Society for Electrical Development, Inc., 29 West Thirty-ninth Street, New York City.

The next meeting of the executive committee of the society is to be held on Tuesday, May 13. Already the organization is accomplishing valuable results in the line of its efforts. Recently a central-station company appealed to the society for aid in starting a new-business campaign. Secretary P. S. Dodd visited the community to study the situation, and since his return the society has received a letter from the local management declaring that even should the society do nothing more than it has already done in this instance, the company feels that it has received more than the value of the $700 paid as its share of dues in the society's membership.

New York Hydroelectric Plans

By Arthur Williams

The New York Conservation Commission is making every effort in favor of the Murtaugh-Patrie bill, and the commission's endeavors have met with success so far, since the bill has already passed the Senate and will shortly be brought up for vote in the Assembly. This legislation as at present drawn up provides for service in the capital district, promising a price varying from $7.50 to $10 annually per horse-power. I am told, however, that lying behind this promise there is a "joker," to the effect that the commission intends to render service only part of the day at this price and then double it if the service be made continuous for twenty-four hours.

I should not be surprised at any kind of mental reservation on the part of the commission. The chairman has repeatedly stated in public that there is 12,000 hp available continuously every day in the year. This is a deliberate misstatement. All engineers agree that for practically half of the year the amount is materially reduced. The best information we can get is that 12,000 hp is available only 175 days of a low year, and but little longer in an average year. In this connection the expert, Mr. M. G. Barnes, a very competent authority in my judgment, in his letter to the commission states: "To supplement this hydraulic plant there should be installed a steam plant of 11,000 hp capacity."

The pending bill cuts the total cost of this particular development in two. The object, of course, is to escape a referendum by keeping the amount under $1,000,000. Should a single bill be introduced, including the water-power development and the steam plant, the total cost would exceed $1,000,000, and thus a referendum would become necessary. This those behind the scheme clearly desire to avoid.

The Conservation Commission makes no secret regarding its larger plan of ultimately selling energy at cost to every municipality of the State. This is simply an "entering wedge." The commission purposes an expenditure of from $250,000,000 to $300,000,000, which will at least be duplicated in distributing systems to be erected by local municipalities. It further purposes entire independence of the Public Service Commissions of the State. Thus, being producers, its members would also make prices as sellers and would stand unregulated in every respect by other than their own authority.

Were the situation not so serious, it might be thought that one feature of the bill was introduced simply as an element of humor. I refer to the provision which permits the commission to exclude practically every element of the cost of operation and charge it to capital account during the first four years of operation. The capital account will, of course, be supplied by taxing the entire State. Can anyone conceive a policy more destructive to present investments or a more satisfactory or complete way of opening all doors leading through the state treasury to the pockets of the people? It is inconceivable that any public official having this feature of the bill brought to his attention can vote in its favor.

As the bill, however, has passed the Senate and is now pending final action in the Assembly, with the Lieutenant-Governor personally—as a high state official and president of a private newspaper corporation in Albany—doing all he can to push it, the chances are that, notwithstanding this

and its other "jokers," it will pass by an overwhelming majority.

As I have said, nothing has ever appeared in our Legislature so destructive to all the interests of the State. I am not referring to the electrical interests alone. Consider what will happen to the manufactures of every municipality which will be thrown into competition with state-produced and state-subsidized power, sold at a price with which even the cheapest service of Niagara cannot compete.

As the enormity of the thing dawns upon the people of the State, I believe they will rise with that form of slow, cumulative and destructive anger which will sweep out of public office every man who had anything to do with legislation of this character.

Unless the people of the State, however, are immediately aroused—and the State's civic associations and the representatives of the electrical industry are the ones to do it—it may be a case of "locking the door after the horse has been stolen." This, it seems to me, is the serious danger of the moment.

Maine Public Service Commission Appointed

The appointment of the three members of the new Maine Public Service Commission, in accordance with the utility law recently enacted by the State Legislature, was made public by the Governor on April 1. The commission as named will consist of Messrs. L. B. Deasy, of Bar Harbor, chairman; W. B. Skelton, of Lewiston, and Joseph Williamson, Jr., of Augusta. Messrs. Deasy and Skelton are Republicans and Mr. Williamson is a Democrat. All three members of the new board are attorneys and have had much experience in dealing with corporation matters. The selections made by the Governor in naming his appointees have been generally commended in the State, and the opinion is expressed that under their administration the law recently passed by the Legislature will result in good to both the public and the utility corporations.

A. I. E. E. Pittsburgh Meeting on "Mining"

Under the auspices of its committee on the use of electricity in mines, the American Institute of Electrical Engineers will hold a meeting at Pittsburgh, Pa., Friday and Saturday, April 18 and 19, to be devoted to the discussion of mining subjects. Mr. George R. Wood, consulting engineer for the Berwind-White Coal Mining Company, is chairman of the committee on mines.

Following the opening address by President Ralph D. Mershon at 10 a. m. Friday, the following papers are scheduled:

Friday morning—"Purchased Power in Coal Mines," by Mr. H. C. Eddy, American Gas & Electric Company, New York City; "Central-Station Power for Mines," by Mr. J. S. Jenks, assistant general manager West Penn Traction & Water Power Company, Pittsburgh, Pa.; "Safeguarding the Use of Electricity in Mines," by Mr. H. H. Clark, United States Bureau of Mines, Pittsburgh, Pa.

Friday afternoon—"Electricity as Applied to Mining," by Mr. J. W. Hopwood, master mechanic United Coal Company, Pittsburgh, Pa.; "Central-Station Power for Coal Mines," by Mr. C. W. Beers, electrical engineer Lehigh Valley Coal Company, Wilkes-Barre, Pa.; "Alternating-Current Motors for the Economic Operation of Mine Fans," by Mr. F. B. Crosby, General Electric Company, Schenectady, N. Y.

Saturday morning—"Characteristics of Substation Loads at the Anthracite Collieries of the Delaware & Lackawanna Railroad Company," by Messrs. H. M. Warren and A. S. Biesecker, Scranton, Pa.; "Mining Load for Central Stations," by Messrs. Wilfred Sykes and Graham Bright, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Question box.

The question box is intended to afford to those who do not care to participate in person a means of communicating topics for discussion. Anyone desiring to bring up points in connection with the use of electricity in mines is cordially invited to send his communication to the secretary, or place it in the box in person.

On Friday evening at 6 o'clock a Dutch dinner will be held at the Fort Pitt Hotel. There will be several addresses, although it is planned to close these exercises by 8 o'clock, leaving the evening open to the individual plans of the delegates.

Demonstration of Effects Produced by Radioactive Substances

In order to give his audience a clearer conception of the effects produced by the presence of radioactive substances, Prof. Edward P. Adams, of Princeton University, interpolated a supplementary lecture in place of the third lecture which he was to have delivered before the American Institute of Electrical Engineers in New York on April 2. The object of the change in program was to demonstrate in more tangible form some of the effects which have been spoken of in the previous lectures, reported in the *Electrical World* of March 22 and March 29.

The first experiment showed the effect of a magnetic field upon a stream of cathode particles in a vacuum tube and illustrated how they are deflected from their path by its action. Next, by interposing a radioactive substance between the plates of an air condenser Professor Adams demonstrated that the air in the vicinity of such substances becomes a conductor. Allowing a wire to become coated with radium emanations, it was shown how the period of decay is observed and measured. In closing, Professor Adams presented figures showing the energy extant in one gram of such a radioactive substance as uranium to be 24,000,000 hp-seconds.

President Ralph D. Mershon announced that the remaining lectures will be given on April 9 and April 16. Owing to the enthusiasm with which these lectures have been received by the audiences arrangements have been made with Professor Adams to deliver the same series before the Schenectady Section, A. I. E. E., in the near future.

The Street Lighting and Fixtures of New York City

On March 28 Mr. C. F. Lacombe, chief engineer of light and power of the Department of Water Supply, Gas and Electricity of New York City, lectured before the New York Electrical Society on "The Street Lighting and Fixtures of New York City." Illustrating the subject with a large number of slides, Mr. Lacombe gave a most interesting description of the way in which the street lighting of New York had been developed from crude beginnings to the present condition. The author referred to the diversified problems of the engineer in the lighting of a city like New York. The illumination must be in proportion to the needs of the various streets or sections and to their importance. A system must be capable of great increase without expensive change of equipment; it must be laid out on economical and efficient lines, and judicially fair prices must be obtained; glaring lighting must be eliminated, and the system must be as artistic as possible.

In order to obtain these conditions the municipal administration, the central-station company, the artist and the engineer can well work together. The administration should provide the necessary funds for steady progress in lighting, both in extension of service and improvement in illuminating units, etc.

Within limitations the artist should not demand extremely artistic design in lighting. It is too costly except in certain instances. In the general lighting of a great city the useful side must have as great weight as the artistic.

The engineer should not cling too closely to the most efficient and economical devices which only obtain the greatest illumination at the lowest cost, for the lighting must be made agreeable to the eye. In street lighting, unless surrounding buildings are to be specially illuminated, the useful rays are those that can be directed toward the ground. To make this agreeable, the light source of an arc lamp, for instance, must be converted into a ball of softened light by diffusing globes or shades, the light so far as is possible being directed toward the ground by either interior or exterior reflectors. This decreases the efficiency to a certain extent, by the absorption of the light, and demands either closer spacing or more powerful sources of illumination at greater heights from the ground. It is, consequently, more expensive.

The naked source of the light produces glare and is not so agreeable, although very useful and less expensive. Considerable success in suburban sections of the city has been attained by abandoning the intense arc unit and using three or four 60-cp or 70-cp tungsten lamps, which produce better distribution, with less glare, at about the same cost.

The efforts of all should be devoted to the extension of diffused lighting in sufficient amount. The administration, the company, the citizen, the artist and the engineer should all work to this end. The progress of the present street-lighting plans depends on the aid the other factors in this work give the engineers in charge.

Referring to the future, the speaker said that in the borough of Manhattan the locations of the posts for street lighting have been determined, and only more powerful illuminating units are needed in order to bring out the full effect of the proposed system. The increased efficiency of the tungsten lamp over the carbon lamp gives more illumination per unit for the same energy consumed, and hence in the suburban districts the illumination can be increased by changing lamp for lamp without any more expense for energy consumption. The 150-watt unit will give excellent results for side streets in Manhattan.

Among the larger units, the flaming-arc lamp of the long-burning type is now nearly perfected. Its large illuminating power per watt makes it very desirable, and it is now being used and will be used to illuminate streets in the center of the city in areas which are congested at night.

In addition to these, magnetite-arc lamps can be used in districts where series arc lighting is in vogue. The flaming-arc lamp and the magnetite lamp are both types which would be used in important sections or streets. By far the greater territory in the city will be covered for a long time to come with the standard inclosed carbon arc lamp and the mantle gas lamp with either upright or inverted mantles. It is believed, said the speaker, that with these illuminating units the lighting of the city can go forward as rapidly as desired, within the physical and financial limitations, and that the city in due time will become the best lighted in the world.

The Problem of the Second-Hand Automobile

Mr. Ralph Temple, who says that he was the first automobile dealer in Chicago and that the first automobile he had to sell was an electric pleasure car, addressed the Chicago Section of the Electric Vehicle Association on March 18. Mr. Temple, who devotes his attention at the present time exclusively to pleasure automobiles, claimed that the electric is driving the gas car out of the cities to a considerable extent. In relation to pleasure cars the idea of doing away with season models, as the "1913 model," the "1914 model" and the like, is a good one; the idea of attaching dates to models in this manner should not be allowed.

Mr. Temple devoted a considerable portion of his remarks to the number of second-hand cars which are in the possession of dealers, referring, of course, to pleasure cars. He said that an unfortunate situation had arisen by the eagerness of agents in the past to make deals and their willingness to accept old cars, often at an inflated value, in making the trade. In disposing of these cars a few dealers in second-hand machines have no doubt resorted to dishonest practices. One trouble has been that the manufacturers of pleasure cars have not been sufficiently interested in the problems of the agents. Until recently the demand for the automobile has been so great that the manufacturer could afford to look with indifference on the troubles of the agent. The remedy, of course, is for the agents to trust one another and to co-operate, probably by establishing a clearing house for second-hand automobiles which will treat all the contributing agents on precisely equal terms.

In answer to a question the speaker described the free inspection system which he has established in connection with the sale of electric vehicles. Customers' cars are, or may be, inspected every two weeks, either at Mr. Temple's repair shop or, in the cases of suburban owners, at the customers' premises. There was considerable discussion of the general subjects of prices, price-cutting and discounts, and the general opinion of the commercial-vehicle men present seemed to be that their business is in a healthier condition than the pleasure-car business, as represented by the speaker of the day. Mr. Temple said that the men engaged in the commercial-vehicle business should profit by the lessons to be drawn from the mistakes made by the pleasure-vehicle dealers.

Turners Falls Hydroelectric Developments

Extensive developments are being planned by the Turners Falls Company, Turners Falls, Mass., near its present generating station on the Connecticut River. The present station, which is rated at 7000 hp, receives its water through a canal which is diverted from the river above the town of Turners Falls. This canal is to be extended more than 2 miles to Montague City, where a fall of 60 ft. will be obtained. A new dam which is under construction will provide sufficient storage for the generation of 40,000 hp during eight months of the year.

The power developed at Turners Falls is sold to a number of allied companies which act as distributors. Among these are the Franklin Electric Company, the Greenfield Light & Power Company, the Amherst Power Company, the Amherst Gas Company and the Easthampton Gas Company. The Amherst Gas Company and the Easthampton Gas Company have also generating stations on the Deerfield River. A description of these stations was contained in the *Electrical World* of Sept. 9, 1911.

A high-tension line from the station at Turners Falls is at present being built through Greenfield, Amherst and Chicopee, with a branch to Easthampton. The main line will probably later be extended across the Connecticut River through West Springfield. A substation is being built at Chicopee which will present some interesting features. It will consist of three 1500-kw single-phase outdoor oil-cooled transformers, stepping down the emf from 66,000 volts to 13,200 volts, and outdoor oil switches, lightning arresters and disconnected switches on the 66,000-volt side. Space will be provided for two similar transformers banks. Within the substation there will be installed in concrete cells double 13,200-volt busbars and oil switches for the distribution of energy. The local distribution in the town of Chicopee and vicinity will be at 13,200 volts. In the same station will also be installed two 500-kw synchronous motor-generator sets with space provided for a third set of the same rating. These sets will be used to supply energy to the Springfield Street Railway Company in Chicopee. The substation is built for an ultimate rating of 15,000 kw. The

company is also building a substation at Amherst, which will be a sectionalizing station in the transmission line and will also contain transformers for local distribution by the Amherst Gas Company.

The power plant at Turners Falls will be relayed by a steam plant of the Greenfield Electric Light Company at Greenfield and one of the Easthampton Gas Company at Mount Tom. A 66,000-volt branch circuit will connect the Amherst substation with the Mount Tom steam station. The transmission line is complete as far as Amherst and will be finished to West Springfield in June. The Chicopee substation will be ready for operation about July 1.

Industrial Illumination and Safety

For the purpose of discussing industrial lighting and its relation to the illumination of machinery and manufacturing processes so as to insure safety to the workmen in various ways a joint meeting was held at the Engineering Societies Building, New York, on March 13, by the following societies: New York Association for the Blind, Committee on Prevention of Blindness, American Museum of Safety, American Society of Mechanical Engineers and the Illuminating Engineering Society.

Dr. Ellice M. Alger presented a paper on "Illumination and Eye-Strain," in which he called attention to the causes of eye-strain and discussed the subject of proper illumination.

The results of eye-strain, the speaker said, are manifold and affect no two people exactly alike. They include pains in the eyes and many functional defects of vision and quite possibly often result in organic eye disease as well. They cause 80 per cent of the chronic headaches. They result often in functional disturbances of other organs and in conditions of general nervous exhaustion and irritability. While most of the symptoms that result from eye-strain are of the accommodative sort, these are all capable of aggravation by improper lighting and there are many that are caused directly in this way.

It has been shown by experiment that the light which gives the maximum of illumination with the minimum of irritation of the eye is composed of the yellowish rays from the middle of the spectrum. The light from most of the more recently developed lamps, whether gas or electric, contains a much higher proportion of the short violet or actinic rays, and sometimes it contains many of the ultra-violet rays as well. Prolonged exposure to the light of the electric arc lamp sometimes produces an intense conjunctivitis with contraction of the pupils and erosions of the cornea, which fortunately generally yield readily to treatment. Nearly everybody has experienced the discomfort and premature fatigue that come from reading by unshaded incandescent lamps. Even if they do not actually produce inflammatory changes themselves, they certainly render those already present decidedly less tolerable.

It is quite possible, however, that the delayed actinic effects of light, whether natural or artificial, are much more serious. The ultra-violet rays are arrested by ordinary glass, and in the eye by the tissues of the cornea and lens, so that the deeper structures of the eye escape harm, but there is strong reason to suspect that their constant absorption by the lens may be one of the causes of cataract. But even if the ultra-violet rays do not reach the deeper structures of the eye one must not forget that the shorter waves of the visible spectrum have decided actinic properties.

The speaker suspected that less intense and longer continued light irritation may be a factor in degenerative changes in the retina and choroid, and advised the use of amber glasses and shades of such composition as to soften the light and exclude the actinic end of the spectrum.

In comparing natural and artificial light the speaker said that in order to obtain illumination like the "north light," which is soft and even and well diffused, the artificial illumination must be much more concentrated and intense. This causes retinal exhaustion, and the retina is capable of reacting only to powerful stimulation. In other words, the retina becomes practically blind when subjected to sudden changes. This and other factors such as deep shadows due to poor artificial lighting are potent in causing industrial accidents.

With bad lighting the output of each individual is manifestly less than it should be, there is a larger percentage of mistakes and material spoiled, and the number of accidents, large and small, is vastly increased. It goes without saying, said the speaker, that any system of scientific management worthy of the name implies good lighting as one of the first requisites.

In a paper on "Industrial Lighting," Mr. Ward Harrison discussed the advantages of good illumination and the economical benefit to the plant owner. The speaker emphasized three points: plenty of light on the working plane, even light distribution on surroundings, and avoidance of glare. The observance of these principles is likely to result in longer service of employees, reduced number of accidents, and greater output with consequent greater financial return. Methods for obtaining such results were discussed and illustrated by lantern slides showing interior views and distribution diagrams. In discussing the relative merits of glass and steel reflectors the former were recommended because in using this kind of reflector some light is distributed in the upper hemisphere, thereby improving the general illumination and giving a less gloomy appearance to the factory. The spacing of lighting units and the effect of various arrangements upon general illumination and the illumination of vertical surfaces, the percentage of light absorbed by walls, columns and other vertical surfaces, first cost, cost of operation and ratio of cost of light to cost of labor were further subjects discussed by the speaker.

The subject of illumination from the mechanical engineer's standpoint was discussed by Mr. A. C. Jackson, of Philadelphia, who emphasized the importance of proper illumination in order to obtain the desired efficiency of plants such as machine shops. Building constructions most suitable for various purposes, arrangements for natural and artificial light, interior finish, placing of machinery, cost of adequate lighting and other subjects of interest were discussed by this speaker.

Turbo-Alternator Plant for the World's Largest Office Building

In an address before the St. Louis League of Electrical Interests, Jovian Chapter, March 25, Mr. Henry H. Humphrey, consulting engineer, St. Louis, Mo., described the equipment of the new Railway Exchange Building in St. Louis. This twenty-five-story structure has a content of 15,500,000 cu. ft., making it the largest office building in the world. The lower seven floors and basement will be occupied by a department store, the floors from the eight to the sixteenth by railroad companies, and the five remaining stories by standard offices, 105 to the floor. Steel skeleton construction has been employed, with wall facings of cream-colored terra cotta.

The steam-heating and electric plant for the building, as well as the shipping department of the store, will be located in a ten-story 66-ft. by 148-ft. warehouse building on St. Charles Street, a block distant from the Exchange, with which it will be connected by a basement-level tunnel 18 ft. wide and 10 ft. high. Besides the service cables and pipes, this tunnel will contain twenty-three package conveyors connecting with carriers traversing the warehouse floors.

Power-Plant Apparatus

The steam-boiler equipment consists of four 500-hp Heine water-tube boilers designed to operate at 225 lb. steam pressure, equipped with Green chain grates and Foster superheaters. The electrical generating machinery comprises three 750-kw, three-phase, 60-cycle delta-connected General Electric turbo-alternators designed to operate non-condensing with steam at 50 deg. superheat and 225 lb. pressure. There are also three 300-kw rotaries for transforming three-phase, 60-cycle energy into direct current for the elevators and large fan motors. Two of the boiler-feed pumps are electrically operated, the third being a steam-turbine-driven centrifugal pump. The plant stack is 9 ft. in diameter and 270 ft. in height.

The power plant will be installed and operated by The Light & Development Company of St. Louis, which will furnish the heating and mechanical service of the building. This company has contracted, however, for a summer connection with the central station of the Laclede Gas Light Company, so that by co-operation between the isolated plant and the central station, the former will be operated only during the heating season and central-station service will be used during the summer.

Heating and Refrigeration

The heating and ventilation of the building is divided at the second story, the first floor and basement being handled by the hot-blast system. Above the second story only direct radiation is furnished. The total amount of this direct radiation is 133,000 sq. ft. of heating surface, making about forty carloads of radiators.

Refrigerating machinery in the power plant consists of two 50-ton refrigerating machines chain-driven by 75-hp motors. One is an alternating-current motor, the other being a direct-current machine. Ammonia piping is carried through the tunnel to the Exchange sub-basement, where a brine cooler, brine storage tank, two brine circulating pumps, two ice-water coolers and two ice-water circulating pumps are placed.

The vacuum cleaning system in the building will consist of four six-sweeper units, two for the use of the store portion and two for the office portion of the building. All these machines will be in the sub-basement, having remote-control switches so that they can be started or stopped from any floor. The vacuum system was especially selected to handle water used for scrubbing or in case of the emergency operation of the sprinkling system.

Electric Distribution Systems

The electrical service for the building is of three kinds, part being a direct-current, two-wire, 230-volt system for the elevators and fan motors and part an alternating-current three-phase, three-wire, 230-volt system for the pumps and smaller store motors, while all the lighting will be by three-wire, 115-230-volt, single-phase circuits fed at the switchboard from a three-phase delta-connected 230-volt system. This has led to some complication in the work, particularly in view of the fact that the type of motors has been changed as contracts were let, requiring changes in wiring from one system to the other.

The lighting on the store floors consists, as a rule, of five outlets per bay, four of these being for lighting and one at the center of the bay for a fan. On the typical railroad floors, from the eighth to seventeenth inclusive, there are, as a rule, six 100-watt outlets per bay with 150-watt outlets at the base of each column for connecting desk fixtures. On the typical office floors, from the seventeenth to twenty-first inclusive, six 100-watt outlets are provided in the ceiling of all offices, while base outlets are arranged, four to an office, for connecting desk lamps, desk fans, etc.

The total connected load for lighting in the building is approximately 1600 kw. The switching of all outlets throughout the store will be controlled from cabinets.

Elevator and Motor Equipment

The twentieth-story elevators are of the two-to-one traction type, having direct-connected motors operating at 125 r.p.m. There are also eighteen office-building elevators running from the first to the twenty-first story. Each has a capacity of 2500 lb. at a speed of 550 ft. to 600 ft. per minute. They are all of the one-to-one traction type, with 40-hp direct-connected motors operating at 62 r.p.m.

The number of motors used in the building aggregates 126, a total rating of 2073 hp. The elevator, escalator and large fan motors, as well as the package-conveyor and pneumatic-tube motors, are all supplied with direct current, making a total of 1587 hp. The pumps, vacuum-cleaning machinery, etc., are driven by alternating-current motors, making a total of 486 hp.

The capital invested in this enterprise is approximately $15,000,000, of which $10,000,000 covers the valuation of the 228-ft. by 271-ft. ground plot. This includes the mechanical and electrical equipment and also the plumbing and sprinkling apparatus, the cost of which is approximately $1,000,000. This is 20 per cent of the entire building investment and is exclusive of the boilers, turbines and other strictly generating-plant equipment.

The architects who designed this building are Mauran, Russell & Crowell, and the Westlake Construction Company is the general contractor.

The contractors for the electrical work are L. K. Comstock & Company.

Keokuk Water-Power Plant Ready in June

In June of this year, the Mississippi River Power Company announces, the great water-power plant now nearing completion in the Mississippi River at Keokuk will be turned over to the operating department. Already the water has been raised 12 ft. behind the dam, while the power-house building itself is practically completed. Three units are now in place, and one of the exciters is ready for operation. The 9000-kw transformers stepping from 11,000 to 110,000 volts are being erected, and the various switching equipment, including switchboards, oil-switches, etc., is about complete. For high-tension buses 2-in. iron pipe suspended on seven-disk insulators has been used.

For the 144-mile 110,000-volt transmission to St. Louis the six 300,000-circ. mil copper cables are suspended from 79-ft. steel towers by special seven-unit 10-in. disk insulators. The towers are spaced at 800-ft. intervals and are connected by a 0.5-in. steel ground wire.

Altogether in the erection of the plant 10,000 carloads of material have been received and distributed, the total labor being equivalent to the effort of one man working ten hours a day for 5000 years. For directing the construction 2600 drawings have been required.

Big Meadows Dam Altered to Gravity Section

After nearly reaching completion according to the original plans for an Eastwood multiple-arch structure, the Big Meadows Dam of the Great Western Power Company on the Feather River in California is now to be altered to make it of the gravity-section type. The power company voluntarily proposed the change in the type of the dam, and the altered plans have been approved by the Railroad Commission of California, which passes on all specifications.

In its decision the commission declares that the greatest stability of the dam is of the utmost importance for the public safety, in view of the enormous amount of water which the structure will impound. The commission has granted the Great Western Power Company authority to issue $4,411,000 worth of additional securities, of which $1,607,635 is to be expended for the completion of the Big

Meadows Dam, including its alteration from multiple-arch design to gravity section.

The storage basin to be created by the Big Meadows Dam will impound 45 sq. miles, or 1,660,000 acre-ft., making it the largest artificial reservoir in the world. The 660-ft. length of the dam was originally composed of twenty-two 30-ft. inclined cylindrical arches. Its crest will be 180 ft. above the base, although the dam will make available a total operating head of from 4000 ft. to 4400 ft. Utilizing 2500 cu. ft. of water per second, about 550,000 hp will be obtainable from the flow of the Feather River.

Hydraulic Storage for Peak-Load Service at Salt Lake

The Utah Light & Railway Company, Salt Lake City, is rearranging its hydroelectric installation in order to take care of peak loads more effectively, and for this purpose is now constructing equalizing reservoirs. The water used at its hydroelectric plants is employed farther down the stream by the farmers for irrigation purposes. For this reason it is impracticable to impound water for peak-load hours in the usual way because such a plan would interfere with the continuity of flow below the station. But by the installation of reservoirs at both the intake and tailrace the difficulty is avoided, and this plan the company is following at its Ogden and Cottonwood Canyon plants. By this means it will be enabled to carry 50 per cent more load during the rush hours. The new equipment purchased for the Ogden Canyon station includes two 3750-hp Morgan-Smith waterwheels, each directly connected to a 2500-kva Westinghouse generator, a bank of three 875-kva Westinghouse transformers for stepping up the emf to 45,000 volts, switchboard, appliances, etc. At the Ogden Canyon station the company is installing a new 1000-kva Morgan-Smith waterwheel and four Westinghouse generators, with corresponding transformers, switchboard, etc.

Electricity Thieves Punished in Los Angeles

Like other cities, Los Angeles has a small proportion of electricity users who scheme to defraud the electric-service company. In two instances recently offenders of this sort were detected and punished by representatives of the Los Angeles Gas & Electric Corporation. One case was that of a resident on Denker Avenue. A woman neighbor complained that, although she used only about one-third as much light as the householder under suspicion, her bills were considerably higher. Upon investigation it was found that the man living in the suspected house was an electrician. A detective meter was set in the usual manner by running an extra pair of wires and placing the meter on a pole some distance away from the house. After getting several readings, which showed to a certainty that the suspect was making a regular practice of stealing electricity, the inspector called at the house and found a jumper wire connected around the meter. This wire was taken as evidence, and the offender was notified to call at the office of the company. This he did and after some questions he made a confession. After a conference it was decided that the man should be arrested. This was done, and, in the Police Court, the culprit received a suspended sentence of six months, with the understanding that he was to make satisfactory settlement with the company for the electricity which he had consumed by his fraudulent practice.

In the other case it was noted by one of the inspectors of the company that a customer on Echo Park Avenue was operating an electric heater during the middle of the day, although the bills sent to this residence called for the payment for only about 5 kw-hr. or 6 kw-hr. per month. To avoid arousing suspicion an inspector was sent to examine all the meters in the block. When the meter at the house in question was reached the inspector found that the pressure wire was loose in it. A few days later a new circuit was put up running past the house, and this was connected to the secondaries supplying energy to this particular residence. A detective meter was set a considerable distance away. In this case also the suspected person was an electrical man, and he discovered the detective meter after it had been installed about three weeks. In order to increase the registration on his house meter he climbed the pole in front of his house and reconnected the secondaries back to the old wires; he then turned on every lamp in his house and also the 500-watt heater. However, he defeated his own purpose, because the connections were made poorly at the pole and the comparatively heavy load caused the wires to become red hot, setting the pole on fire. The emergency crew dispatched to investigate the cause of the fire interviewed the too-ingenious lineman and got a confession from him, and it was through this evidence that a conviction was obtained in the Police Court. The man was fined $25, with the understanding that he should also settle in full with the company for all electricity which the company estimated had been used and that he pay also for the expense to which the company had been put in stringing the extra wires and setting the detective meter.

Pneumatic-Tube Systems for Mail Delivery

Representing a committee of Congress, Commander A. B. Fry, of New York, is making an investigation into the extent, character and physical condition of all the pneumatic-tube systems utilized by the government in various cities of the United States in connection with the transportation of mail matter. The examination is being made with the idea that the government may purchase all of these pneumatic-tube systems at a possible cost of several million dollars. The Chicago Postal Pneumatic Tube Company, which has offices in the Federal Building, is the private company which conducts this service in Chicago. It has three air-compressing plants, two electrically driven and one steam-driven, the last named being installed in the basement of the Federal Building. Mr. William A. Richardson, assistant chief engineer of the United States Post Office and Court House, Chicago, has made an investigation of this system. Elaborate tests have been made as to the condition of the power plants, air leakage in the pipe lines, possible dangers from electrolytic corrosion of buried tubes and the condition of the engines, compressors, motors, etc., in the power plants.

Electricity from Lumber-Mill Refuse at Vancouver, B. C.

The Vancouver (B. C.) civic committee on abatement of the smoke and sawdust nuisance has, after several months spent in considering ways and means to obviate those two evils, recommended to the Council acceptance of the Public Service Corporation's proposal to supply for lighting, heating and motors electricity generated from the lumber mills' waste. It is the company's intention to develop electricity and steam heat from the refuse at the various mills in Vancouver, thus at the same time doing away with a great deal of smoke and sawdust. The franchise asked is for thirty years, but the company is to have no exclusive right to such a franchise. The city is to have an option on purchasing the company as a going concern after twenty years and at the end of each succeeding five-year period. Disputes as to price are to be settled by arbitration.

The service charges to consumers are to be: For electric

light, 8 cents per kw-hr., to be subsequently reduced to 7 and 6 cents; for steam heat, $1 per 1000 lb. of condensation. Discounts of 10 per cent will be allowed on bills paid within ten days. In consideration of the franchise the company agrees to pay the city 1 per cent on the first ten years' gross earnings, 2 per cent on the gross earnings for the ensuing five years, and 2.5 per cent for the rest of the term. The company must start operation within eighteen months and expend $50,000 within this period, otherwise the agreement will lapse.

Court Awards $7,500 of $25,000 Flowage Claim

With the impounding of water behind the great Keokuk dam of the Mississippi River Power Company, now under construction, an island in the river opposite Fort Madison, owned by H. D. Everingham, will be submerged. At the instance of the power company the United States government condemned the island and assessed its value at $2,000 to $3,000. The owner, however, made claims to damages amounting to $25,000 resulting from the loss of his property, and recently brought suit. After visiting the site, the petit jury in the federal court at Quincy, Ill., brought in a verdict on March 27 assessing $7,500 damages for the owner of the island.

Electric Utilities Consolidated in Connecticut

The consolidation has been announced of the Connecticut Power Company, the Middletown Electric Light Company, the New London Gas & Electric Company and the Eastern Connecticut Electric Power Company, under the first-named corporate title. The combined properties will be under the administration of the Stone & Webster Management Association, of Boston, Mass. The Connecticut company also owns the Berkshire Power Company at Canaan, Conn., the Norfolk (Conn.) Electric Light Company, and the Sharon (Conn.) Electric Light Company.

It is proposed to develop at once a hydroelectric plant at Falls Village, on the Housatonic River, utilizing an effective head of 90 ft., with an ultimate capacity of 16,000 hp. About 12,000 hp will be developed this year. A steel-tower transmission line will be built from Falls Village through Torrington to Thomaston and thence to Bristol, with a possible extension to Middletown. Securities issued on the completion of the Falls Village plant will be: Preferred stock, $1,250,000; common stock, $1,000,000; bonds, $2,445,000. Practically all the new issues of securities represent the cash cost of the companies and the cost of construction of the new plant. The Connecticut Power Company has modern steam plants of 2700-hp capacity each, at Middletown and New London, and a small hydroelectric and steam relay plant at Canaan.

New York Progressives Urge Twenty-Five-Year Franchise Limits

A bill introduced in the New York Legislature by Senator A. J. Palmer, of Ulster, and Assemblyman S. Sufrin, of New York City, Progressives, limits the grant of fixed-period public-utility franchises to twenty-five years and of indeterminate permits to a maximum of fifty years. It also provides for the repeal of abandoned franchises and recovery of control of unlimited or perpetual franchises heretofore granted.

The bill declares that in all proceedings involving the rights of corporations now claiming franchises in perpetuity or franchises for a longer period than twenty-five years the burden of proof as to the validity of such franchises shall be upon the corporation claiming them. The public-service commissions are required to make an exhaustive inquiry into outstanding franchise rights for the purpose of ascertaining whether or not the terms and conditions of these franchises have been complied with. The corporations are required to file with the commission copies of all their outstanding franchises, and failure to file such copies is to be prima facie evidence that the franchises do not exist. The proposed act also provides that municipalities may own and operate public utilities.

Mr. Frederick M. Davenport, chairman of the legislative committee of the national Progressive party, is quoted as asserting that the present bill is the most thoroughgoing and advanced measure of franchise legislation that has been introduced in any state legislature.

Exhibition of Accounting Forms at Chicago Convention

Between 8000 and 10,000 forms used in the accounting departments of nearly 125 central stations will make up an interesting exhibit now being prepared for the coming N. E. L. A. convention at Chicago. The forms are to be arranged by companies, a grouping which will facilitate study of the scheme used, for instance, by a given utility operating in a community of a certain size. The first such collection of these forms, made three years ago and exhibited at the St. Louis convention, was grouped according to subjects and attracted much interest, although the present arrangement by companies will, it is believed, prove more useful to those who desire to consult the collection. Of the forms now being handled twenty-six represent plants in cities of 5000 population, twenty-five in cities of 10,000, thirteen in cities of 50,000, eight in cities of 100,000, five in cities of 200,000, and six in still larger cities. The sheets on which these various forms have been mounted will be assembled into volumes for the Chicago exhibit.

Louisville Merger Ordinance Passed

An ordinance providing for the merger of the Kentucky Electric Company, of Louisville, Ky., with the Louisville Gas and Louisville Lighting companies of that city, under the ownership of H. M. Byllesby & Company, Chicago, and also giving the Byllesby interests the right to acquire the Kentucky Heating Company and thus control all public utilities in the Gateway City, has been passed by the General Council of Louisville and signed by the Mayor. This measure has been a vital topic of discussion everywhere in Louisville for months, for the proposed merger is of widespread importance, involving the consolidation of utilities whose combined capitalization is $22,000,000.

The General Council of Louisville, in the terms of the ordinance, is empowered to regulate rates for electricity, natural gas and artificial gas. The present terms of the ordinance fix the schedules for the next twenty years at rates which are acceptable to the parties concerned and to the public. Mr. C. A. Tripp, a utility expert of Indianapolis, Ind., was employed by the Louisville Commercial Club to investigate the proposition, and he recommended several minor amendments to the measure which were accepted as being fair to both sides.

Commission Legislation Pending in Colorado

A public-utilities bill is now receiving much attention in both the House and Senate of the Colorado State Legislature. Originating in the Senate, the bill, which was offered as one of the Democratic party pledges, was before the upper body for more than a week and finally went through with few amendments to the House. Extended

debate there, however, resulted in many amendments, among them the elimination of the requirement of permits for railroads before beginning new construction. The proposed schedule of salaries was also reduced to $3,600 from the Senate figure of $5,000. A clause was added placing municipal utilities under the state commission. Eight sections providing for indeterminate franchises, methods of acquiring ownership by municipalities, etc., were also introduced from the Wisconsin law.

The amended bill was then passed by the House and returned to the Senate, but the latter so far has steadfastly refused its assent to the amendments, and a conference committee has now been appointed. The Senate, it is believed, may be brought to concur in the Wisconsin-law amendments and the House in the larger salary, both of which, it is declared, would tend to give Colorado a utility law inviting capital, protecting against exploitation and securing the continued existence of fair rates and a fair basis for private competition.

Public Service Commission News

NEW YORK COMMISSIONS

The New York Commission for the Second District has authorized the Inter-Village Electric Corporation to distribute electric service in Hamburg, Erie County, and to issue capital stock for $5,000 and first-mortgage bonds for $12,500. The company proposes to purchase the property of the Howard A. Pierce Electric Light Company of Hamburg.

The commission has also authorized the Elmira Water, Light & Railroad Company to sell $339,000 of its first consolidated mortgage 5 per cent fifty-year gold bonds to refund a like amount of bonds of the Elmira Water Works Company.

The commission for the Second District has authorized the Niagara Light, Heat & Power Company, of Tonawanda, N. Y., to issue $60,000 of consolidated and refunding bonds, to be sold at not less than 80 and the proceeds used for discharging current liabilities. The commission has also authorized the Public Service Corporation of Long Island to issue $19,300 of first-mortgage bonds to be sold at not less than 85. The proceeds are to be used to reimburse expenditures for organization and issuing funded debt.

The New York & Ontario Power Company, which has a plant at Waddington, has filed an application with the commission for the Second District praying for a modification of former orders of the commission. The company alleges that it will be better able to finance the further development of its plant and dispose of its securities if its authorized bond issue is reduced from $2,000,000 to $750,000 and the stock issue increased from $750,000 to $2,000,000. At the present time the company has authorized stock amounting to $750,000. It was incorporated with capital stock of $2,000,000. It has outstanding bonds amounting to $2,000,000.

The Second District commission has authorized the village of Hamilton to extend its electrical distribution system beyond its corporate limits into Lebanon to furnish electric service to Randallsville.

The First District commission will increase its engineering staff at once to get out plans for the new subway and elevated lines. About 250 additional engineers and draftsmen will be needed. The commission's engineering staff already numbers 764 engineers, draftsmen, architects, clerks and other assistants, so that the increase will bring its membership up to approximately 1000. Most of the new men will be draftsmen. The increased cost will amount to from $250,000 to $300,000 a year. The civil-service lists from which draftsmen may be appointed have been exhausted, so that new appointments will have to be made provisionally pending examinations. The increase in the engineering force will not necessitate any material addition to the commissions's budget allowance for this year, $1,673,000, since the increase was anticipated. The allowance to the commission for 1912 was about $1,300,000.

OHIO COMMISSION

Judge Marcus G. Evans has issued a temporary restraining order to prevent the Public Service Commission of Ohio from enforcing its ruling authorizing the Farmers' Telephone Company to construct lines and operate in Sidney, Anna and the rural districts of Shelby County. The action was taken at the instigation of the Sidney Telephone Company, whose officials claim it is in position to care for all the business given to it and to furnish service to those who desire it. The application of the Farmers' Telephone Company for authority to invade territory occupied by another company is the first of its kind to be granted by the commission. The step was violently opposed by the Sidney Telephone Company at the hearings. It is stated that the company had its licenses and franchise prior to the enactment of the law under which the order was given, but this was not taken into consideration.

CALIFORNIA COMMISSION

The United Light, Fuel & Power Company of San Diego has filed an amended application with the California Railroad Commission for authority to issue $100,000 of stock.

The commission has granted authority to the San Diego Consolidated Gas & Electric Company to issue $106,000 of 6 per cent debentures. The original application was for $500,000. The proceeds will be used to discharge indebtedness.

The Livermore Water & Power Company and W. A. Bissell have applied for authority to sell their plant to the Pacific Gas & Electric Company for $142,000. The latter company asked for authority to issue 1400 shares of its common stock at 65, in part payment.

The Tulare County Power Company has asked authority to issue $50,000 of stock and use the proceeds in extending its line.

The Petaluma Power & Water Company has filed its answer to the complaint of the city of Petaluma, asking for specifications and particulars of cases in which it failed to provide adequate service.

A decision has been rendered granting the application of the Great Western Power Company for authority to issue $4,411,000 of bonds. The proceeds will be devoted to general improvement, extension and development of the company's facilities. The Big Meadows Dam and Reservoir will be completed at a cost of approximately $1,607,635.

A decision recently rendered grants authority to the Southern Sierras Power Company to purchase the Elsinore Electric Light & Power Company, of Elsinore, for $7,500.

The Northern Electric Railway Company has applied for an order authorizing the sale of a high-tension transmission line between Nicolaus, Sutter County, and Riego, Placer County, to the Pacific Gas & Electric Company for $11,691.37, plus $185.09 interest.

The Los Angeles Gas & Electric Corporation recently applied for authority to issue $900,000 of bonds. The proceeds will be used to purchase the Valley Gas & Fuel Company and new equipment and extensions. The Valley Gas & Fuel Company and the California Coke & Gas Company applied for authority to sell their systems to the Los Angeles corporation.

The California commission has rendered a decision on the complaint of Mr. James P. Glass, of Del Mar, who asked that the Del Mar Water, Light & Power Company be compelled to furnish service to him. The water company contended that a large outlay of money would be required to supply water to Mr. Glass, whose holdings were upon an elevation. The commission decided that the company should supply water to Mr. Glass, that the company and Mr. Glass should divide the expense of the pipe re-

quired for the extension, that the cost of making the connection from this pipe with the property of Mr. Glass should be borne by the plaintiff, and that the maintenance of the extension should be borne by the company.

Massachusetts Commission

The Gas and Electric Light Commission has authorized the Harvard Gas & Electric Company to issue 120 shares of stock at $100 par to meet the cost of establishing its distributing system. The company is owned by the interests in control of the Ayer and Clinton central-station organizations and purchases energy from the Clinton system. The Harvard company has built a transformer station and small distributing system and has erected a high-tension line across the town to connect the stations of the Clinton, Leominster and Ayer companies. It expects to develop a considerable business in supplying large summer residences and to act as the distributor for a wide area of rural and semi-rural territory.

Maryland Commission

Mr. Edward W. Bemis, of Cleveland, has arrived in Baltimore to assist in preparing the brief to be filed by the Protective Telephone Association for reopening the telephone rate case before the Maryland Public Service Commission. Mr. Bemis has been retained to advise on technical matters, with Messrs. Marbury & French, counsel for the Telephone Protective Association. Statistics will be presented to show that business telephone rates in Baltimore are higher than the rates charged for similar service in other cities of the same class. Mr. Osborne I. Yellott, assistant general counsel to the Public Service Commission, will conduct the case. The association, of which Dr. A. R. L. Dohme is president and Mr. Herbert Sheridan secretary-treasurer, has issued an appeal to business men to join its membership and aid in prosecuting the fight before the Public Service Commission.

Stockholders and directors of the Farmers & Merchants' Telephone Company and the Peninsular Light & Power Company, whose plant furnishes service to Denton, Greensboro and Ridgely, have formed a new corporation to take over both the others. Of the new corporation, the Farmers & Merchants' Telephone & Electric Company, Mr. Harry M. Thompson, of Hillsboro, is president and the Rev. George S. Rairigh is vice-president. Among the directors chosen is Mr. T. Piny Fisher, former president of the electric-light corporation. The capital of the new company is $175,000. The Maryland Public Service Commission recently gave its consent to the combination of the two corporations.

The Annapolis Public Utilities Company, which recently bought the Annapolis Gas & Electric Company, has filed a petition with the commission for the approval of a proposed deed of trust in connection with a mortgage. At the same time the Washington, Baltimore & Annapolis Railway Company, which controls the Utilities company, asked for approval of its purchase of the stock of the Utilities company to the amount $110,317.

New Jersey Commission

The New Jersey Board of Public Utility Commissioners has approved the application of the Public Service Electric Company for a one-year lease of the property and franchise of the Cinnaminson (N. J.) Electric Light, Heat & Power Company. The board recommends a study of the situation with the view of simplifying the corporate relations between the Public Service and Cinnaminson companies by merging the latter with one of the Public Service operating companies.

The New Jersey Supreme Court has sustained the decision of the Board of Public Utility Commissioners in denying the application of the Interstate Telephone & Telegraph Company for permission to issue 5 per cent refunding-mortgage gold bonds for $1,525,000. The board had taken the ground that it did not appear to its satisfaction that there was reasonable warrant that the company would be able to pay from its earnings the annual interest the issue would require. The company contended that no reason existed for the refusal inasmuch as the issue was not designed for public sale. The court in its decision says that the act of 1911 creating the commission vests the board with final power to pass and approve the legality of a proposed bond issue payable more than one year after the date thereof. The legal right of the board to make such an order being clear and the question of the jurisdiction of the board to make the order also being clear, the court refuses a writ of mandamus to compel the board to reverse its action and also dismisses the writ of certiorari obtained by the company to set the order aside.

Current News Notes

South African Electrical Engineers.—Mr. J. W. Kirkland, of the South African General Electric Company, was recently elected president of the South African Institute of Electrical Engineers. The headquarters of the organization, which has a membership of 350, are at Johannesburg.

* * *

"Utility Regulation" the Order of the Day.—A bill now before the Kansas Legislature would "regulate" the movements of trains at railroad crossings. "When two trains approach a crossing," orders the proposed statute, "both shall stop, and neither shall go ahead until the other has passed by."

* * *

Linemen at a Premium.—The recent severe wind and sleet storms and floods throughout the Middle West brought about a great demand for linemen to do repair work on overhead lines of telephone, telegraph and electric-service companies. Every available lineman that could be secured was pressed into service, and the men were worked at top speed for long hours, in some cases sixteen hours a day. The bill for extra wages paid by electric utility companies on this account will be enormous.

* * *

Dinner to New England Central-Station Men.—An elaborate banquet was given to the central-station representatives of New England by the General Electric Company at the Copley-Plaza Hotel, Boston, on the evening of March 31. This is an annual event that has steadily grown in proportions from year to year. There were 457 people present at the banquet. Mr. Charles B. Davis, of the General Electric Company, was toastmaster, and the speaker of the evening was Mr. Frederick P. Fish, whose subject was "The Law and the Prophets." Among the long roster of guests were Mr. Charles L. Edgar, Prof. Elihu Thomson, Prof. Ira N. Hollis, Prof. William L. Hooper and Prof. D. C. Jackson.

* * *

Interborough Rapid Transit Company Aids Flood Victims.—Five per cent of the gross receipts from the sale of tickets on New York's subway and elevated lines on Monday, March 31, was contributed toward the relief of the flood sufferers. The statement was made by the company that Monday had been chosen because it is normally the day of heaviest traffic. As the intention of the company had been made public, many of the regular patrons of the subway and the elevated lines took the tip and bought enough tickets on Monday to last a month. The total contribution amounted to $6,073. This indicates that about 125,000 more tickets were bought than during any previous twenty-four-hour period in the whole history of the company.

Arkansas Convention Changed to May 5-6.—The date of the meeting of the Arkansas Association of Public Utility Operators has been changed from May 13, 14 and 15 as formerly announced to May 5, 6 and 7, bringing the sessions one week earlier than at first scheduled. The meeting will be held at Little Rock.

* * *

Successful Use of Gyroscopic Compass.—A gyroscopic compass was installed on the torpedo-boat destroyer *Worden* recently and has since been examined in actual service by a committee of naval officers. This committee reports that the device was found to be remarkably free from oscillation caused by the rolling and pitching of the vessel. Experiments which have been made with the same compass aboard a submarine indicate that with its aid the pilot can direct a more accurate course when the vessel is submerged than with other forms of the mariner's magnetic needle.

* * *

Large Judgment in Personal-Injury Suit.—Not long ago the Board of Trustees of the Sanitary District of Chicago ordered the payment of $20,169.35 to Frank H. Perkins in satisfaction of a judgment in a personal-injury case. The plaintiff sustained severe injuries by coming in contact with an electric-lamp post and wires carrying electricity. He was an employee of the Sanitary District and sued for $50,000 damages. He secured a verdict for $18,000, and this judgment was affirmed on appeal. Interest and costs brought this amount up to the sum first mentioned. The accident occurred in June, 1908.

* * *

What Constitutes Break-Down Service, Anyway?—While undergoing an examination on the subject of break-down charges at the hands of a commission recently, an Eastern central-station man took pains to point out to his inquisitors that despite its franchise monopoly his company was not altogether free from competition, which it has in the shape of gas, oil and other artificial illuminants, and even daylight itself. "Very well, then," commented the chairman with a genial twinkle, "if we are to regard daylight as a competitor of central-station lighting, it would seem to me that every kind of lighting service you give should come under the heading of your break-down service schedule!"

* * *

X-Ray Operator Loses His Hand.—Dr. J. N. Scott, of Kansas City, has, according to a press dispatch, suffered the loss of his right hand as a result of his early experiments with X-rays. Dr. Scott was one of the pioneers in the application of Roentgen's discovery for medical use and, like a number of other scientific and professional men, suffered burns before it was discovered that it was necessary for operators to handle the X-ray with care. After various minor operations it has been found necessary to amputate the hand. Dr. Scott is reported to have said: "Certainly, I shall continue to operate X-rays, or at least to direct their use. Since we have learned how to use them, the rays have not the danger they used to have."

* * *

Elevator Safety Locks Needed.—No less than 322 persons have been killed in New York City passenger elevators owing to improper handling of doors and starting of the cars while passengers were entering or leaving. Of this number eighty-three were killed in 1912 and sixty in 1911. This increasing toll of accidents, culminating in the recent death of a prominent jurist, has drawn public attention to the need for an ordinance requiring the use of automatic devices which will prevent the car from starting while the door is open. A number of such safety devices are available and several states have laws requiring their use. A bill now before the Legislature at Albany would impose a fine of $5 a day for operating any elevator without such safety precautions.

SOCIETY MEETINGS

Pittsburgh Section, I. E. S.—At the March meeting of the Pittsburgh Section, Illuminating Engineering Society, Mr. M. Luckiesh, Cleveland, Ohio, presented an illustrated address on the subject of "Light and Art," pointing out the importance of the proper lighting of statuary, paintings, etc., in conveying the effect intended by the artist. Messrs. C. J. Mundo and S. B. Hibben took part in the discussion.

* * *

St. Louis Company Section, N. E. L. A.—At the monthly meeting of the Union Electric Light & Power Company Section, N. E. L. A., St. Louis, March 28, Mr. Stanley Stokes, of the Mississippi River Power Distributing Company, delivered an interesting address, illustrated with lantern slides, describing the new transformer station on Page Avenue, St. Louis, where the Keokuk energy will be received. Mr. A. C. Einstein followed with a brief talk on the relation of the Keokuk water-power to St. Louis, and Mr. K. H. Hansen made a few impromptu remarks on the connection between the systems.

* * *

Philadelphia N. E. L. A. Activities.—At the meeting of the commercial department branch of the Philadelphia Electric Company N. E. L. A. Section on March 27 Mr. G. Ross Green spoke on the subject of "Education and Training." Mr. H. S. Evans addressed the accounting department branch March 11 on "Time and Efficiency." Mr. Frank P. Cox talked on meter history at the meter section meeting on March 7. At the first regular session of the newly organized engineering-department branch Mr. W. C. L. Eglin, second vice-president of the company, made a brief address. This was followed with papers on substation equipment by Messrs. H. Broadbent and H. C. Albrecht. "The A-B-C of Telephony" was the paper of the evening before the regular Philadelphia Electric Company Section meeting of March 17, presented by Mr. S. P. Grace.

* * *

New Orleans Electric Club.—Sixty electrical men make up the membership of the newly organized New Orleans Electric Club, which elected officers as follows at a meeting held in the St. Charles Hotel, New Orleans: President, Mr. Benjamin Willard; vice-presidents, Mr. Chauncey Franch and Mr. C. S. Barnes; secretary, Mr. T. S. McLoughlin, and treasurer, Mr. W. E. Conery. The board of governors named comprises Messrs. F. W. Stevens, I. G. Marks, T. B. Rhodes and W. E. Clement. H. F. Cameron has been appointed chairman of the membership committee. It is planned to erect a comfortable club building and to take other steps to foster a closer relationship between the branches of the electrical industry in the Louisiana city. Three grades of membership have been determined upon—active, associate and non-resident.

* * *

Meeting of the Tri-State Association.—The Tri-State Water & Light Association of the Carolinas and Georgia has arranged a meeting of special interest to water-works and lighting men on April 15 and 16, at Charlotte, N. C. Mr. M. F. Corin, of Philadelphia, will present a paper on "Preventable Economic Loss in the Operation of a Boiler Plant and Its Remedies." Mr. A. M. Schoen will speak on "Fire Prevention and Fire Protection"; Mr. J. L. Ludlow, of Winston-Salem, N. C., will have for his subject "Conservation of Purity of Public Water Supplies," and Mr. G. H. White, of Columbia, S. C., will discuss "The Effect Purification of the Water Supply Has Upon the General Health of a Community." Exhibits will be made by manufacturers of water-works and lighting supplies. The secretary-treasurer of the association is Mr. J. W. Neave, Salisbury, N. C.

United States Navy Wireless Station

Service trials and operating features of the high-powered radio station at Arlington, Va. By S. M. Kintner, E. D. Forbes, F. H. Kroger and J. L. Hogan, Jr.

THE public has become so familiar with reports of wireless (or radio, as it is now officially called) transmissions of thousands of miles that a daily press reporter experiences difficulty in presenting the results of the range test of the United States Navy station at Arlington so as to attract even passing attention. The fact that such is the case should not, however, be taken as an indication of failure upon the part of the equipment to give a satisfactory and really remarkable performance. The test of the Arlington station equipment described below shows results which establish a record of reliable and continuous long-distance transmission between a ship and a shore station. This test has been made primarily with the object of allowing the National Electric Signaling Company to demonstrate, under service conditions, the effectiveness of the apparatus it has supplied to the Navy Department.

The sending part of the radio apparatus was designed under the direction of Prof. R. A. Fessenden in 1908. It was constructed and had a preliminary test about three years ago, but was not placed in its present location until last winter owing to unexpected delays experienced by the Navy Department in securing a suitable site. The receiving apparatus has been redesigned in order that certain improvements in mounting the several rather delicate parts could be employed. The whole fundamental part of the design, however, does not depart from that originally proposed by Professor Fessenden.

A somewhat detailed description of this station having already appeared in these columns on Jan. 18, 1913, it will suffice for the purposes of the present article to give a very brief outline.

Arlington Station Equipment

The Arlington radio station is located on the brow of the hill at the extreme southern corner of the Fort Myer Reservation, overlooking the city of Washington. The towers supporting the antenna were designed by the engineers of the Bureau of Yards and Docks and were erected by the Baltimore bridge division of the Carnegie Steel Company. Use is made of three towers located at the angles of an isosceles triangle, one side of which runs nearly north and south and has at each of its extremes a 450-ft. tower, while at the other angle a 600-ft. tower is located. The distance between the two 450-ft. towers is 350 ft., while that between the centers of the 450-ft. towers and the 600-ft. tower is 400 ft. These towers are carried on concrete columns and are provided with an insulating plate of marble, the weight of the tower being distributed over this plate by means of a steel casting. Each tower has four legs and four supporting columns. An excellent idea of the arrangement of these towers, together with the support, can be secured from Figs. 1 and 2.

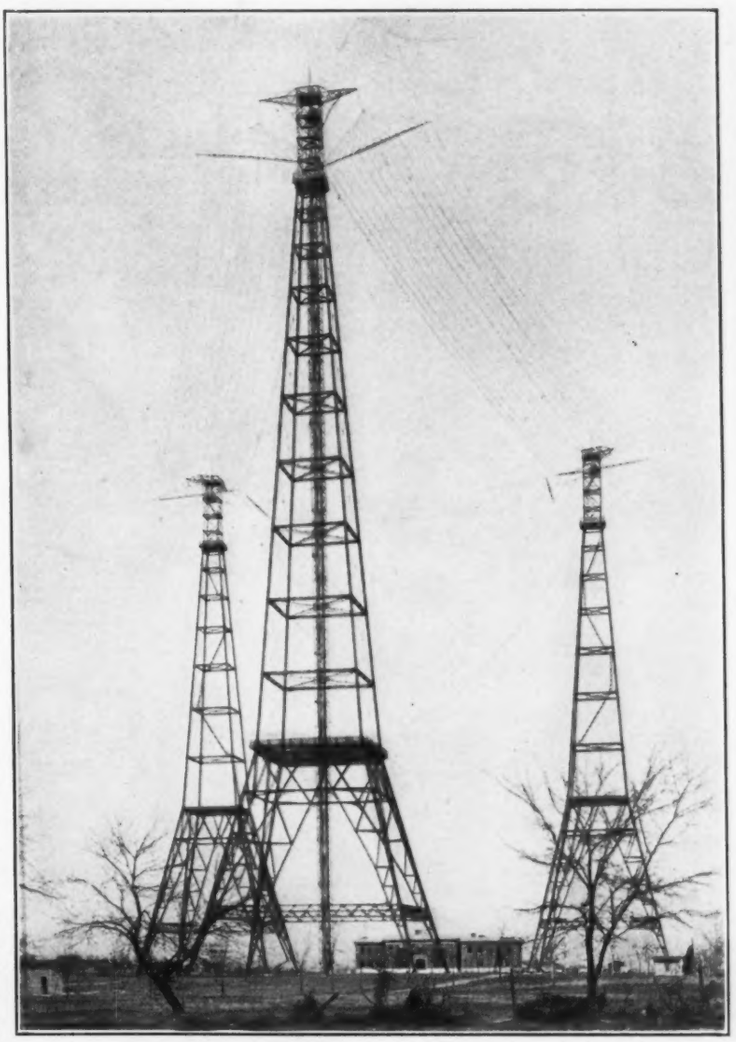


FIG. 1—AERIAL TOWERS AT ARLINGTON STATION

The antenna carried by these towers consists of three horizontal antennas between the three towers, of a type and supported in a manner similar to that employed on the steamship installations, except that the spread of the wires and the number of wires are considerably greater. These three antennas are supplemented by an additional spread of wires which is secured by means of a cable supported between the two smaller towers and to which is attached, at intervals of 10 ft., the antenna wires, which are carried up to a spreader supported by the 600-ft. tower. All of these antennas are joined together and form in effect one enormous fan-shaped antenna, the upper corner of which is approximately 600 ft. above ground while the lower side is slightly less than 450 ft. above ground. These antennas are all insulated by means of porcelain disks, such as are ordinarily employed in the construction of high-tension

energy-transmission lines, arranged in series, as many as ten being employed to provide the necessary insulation. The connection from this antenna to the station is made at the middle of the antenna between the two smaller towers by means of a grid of wire which leads directly down to a pole on which is mounted a switch by means of which the antenna can be connected to either the sending or the receiving rooms or can be connected directly to ground in order to protect it from lightning discharges.

FIG. 2—GROUNDING SWITCH ON INSULATED TOWER LEG

The operating house, which is also illustrated in Fig. 1, is a two-story brick building divided into two separate and distinct parts in order that the noise and vibration produced by the heavy sending machinery can be eliminated from the receiving room, where quiet is necessary in order to secure the best receiving conditions. All the sending apparatus is mounted in the large room provided for this purpose, the rest of this part of the building being occupied by a machine shop, a laboratory and offices of the officers in charge of the navy radio service. All of the receiving apparatus is mounted in a sound-proof room in the other part of the building, in which are also the living quarters of the employees of the station, together with a laboratory for carrying on certain investigations of such a character as not to interfere with the receiving operations of the station.

The energy for the operation of the sending equipment is secured from the Potomac Light & Power Company and is delivered to the station in three-phase, 25-cycle alternating-current form. This energy is used to run a 200-hp Westinghouse synchronous motor, which drives, in addition to a direct-current generator for exciting purposes, a 100-kw, 500-cycle General Electric single-phase alternator. The emf from this alternator is stepped up by means of a General Electric transformer to approximately 25,000 volts, the energy being used to charge Fessenden compressed-air condensers which are in turn discharged by means of a synchronous rotary spark gap, through a high-frequency oscillating circuit. The latter by means of an oscillation transformer feeds the energy directly into the antenna circuit. The control of the current in sending is effected by means of a remote-control switch which interrupts the circuit between the generator and the transformer in the process of making dashes and dots for the Morse code. This control switch is operated by means of an ordinary telegraph key placed in the operating room where the messages are received. Use is made of an elaborate switchboard, on which are mounted the necessary instruments for indicating the condition of each of the several circuits.

The character of radiation sent out by this equipment is very pure in its wave form, being practically seven times as good as that fixed as the legal limit by legislation which became effective last summer. This purity of radiation is due in a large measure to the low resistance of the antenna, but in order that best advantage may be taken of this condition very accurate tuning of the oscillation circuits in the sending apparatus is required. The low resistance of this antenna is in a large measure due to the large amount of copper employed in the antenna proper, together with the fact that an enormous wave-chute, consisting of a great network of buried copper wires covering several acres, is employed as a means of making the ground connection.

It is worthy of note in passing that the transmitting apparatus of this station employs a high spark frequency—that is, 1000 sparks per second—and, further, that this equipment was the first one contracted for by the government in which it was proposed to employ such high spark frequency. High spark frequency has now become standard practice. In its ability to transmit successfully through atmospheric disturbances it gives vastly superior results over those achieved by the old low spark frequency, which suffered such serious interruptions in the transmission of messages during certain periods of the year.[1]

The constants of the antenna taken after adjustment for the test were as follows: Capacity, 0.01 microfarad; inductance, 0.123 millihenry, and an equivalent resistance of 2 ohms. The power input was about 72 kw and a wavelength of 3800 m was used, experiments having shown this to be the best for sending to the ship. The oscillations are particularly persistent, the logarithmic decrement per complete period being only 0.031.

That the insulation of the antenna, switches, etc., is ample is evidenced by the absence of any corona during operation at the maximum voltages employed.

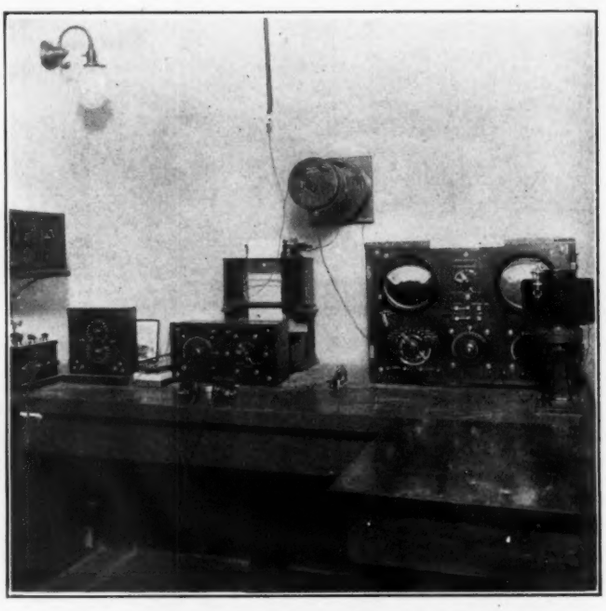


FIG. 3—HETERODYNE AND RECEIVING EQUIPMENT

One feature that attracts the attention of every one familiar with high-power radio installations is the compact arrangement of the sending set. This has been brought about largely by the employment of compressed-air condensers, supplemented by an assembling of parts to the

[1] U. S. patent 918,306; applied for July 1, 1907; issued April 3, 1909.

best advantage. The arrangement of the apparatus and the connections are clearly shown in Fig. 4. The use of compressed-air condensers not only economizes in floor space but also increases the operating efficiency very materially. A total capacity of 0.126 microfarad in compressed-air condensers is used. The dielectric losses of glass and oil when subjected to the high frequencies employed in this service are very serious and, aside from the actual energy loss, cause considerable trouble from heating with its resultant difficulties. The compressed-air condenser is notably free from such losses.[2]

The receiving equipment consists of condensers and inductances together with a suitable oscillation transformer, all being provided with means of adjustment which permit the accurate tuning of each of these several elements so as to secure the best possible results. The detectors employed are the Fessenden liquid barretter[3] and the Nescon crystal detector.[4] The arrangement of these instruments is shown in Fig. 3.

In addition to the receiving apparatus described above the heterodyne receiver[5] was employed at times when the signals were exceedingly faint, or when interference from other stations was apt to prevent accuracy.

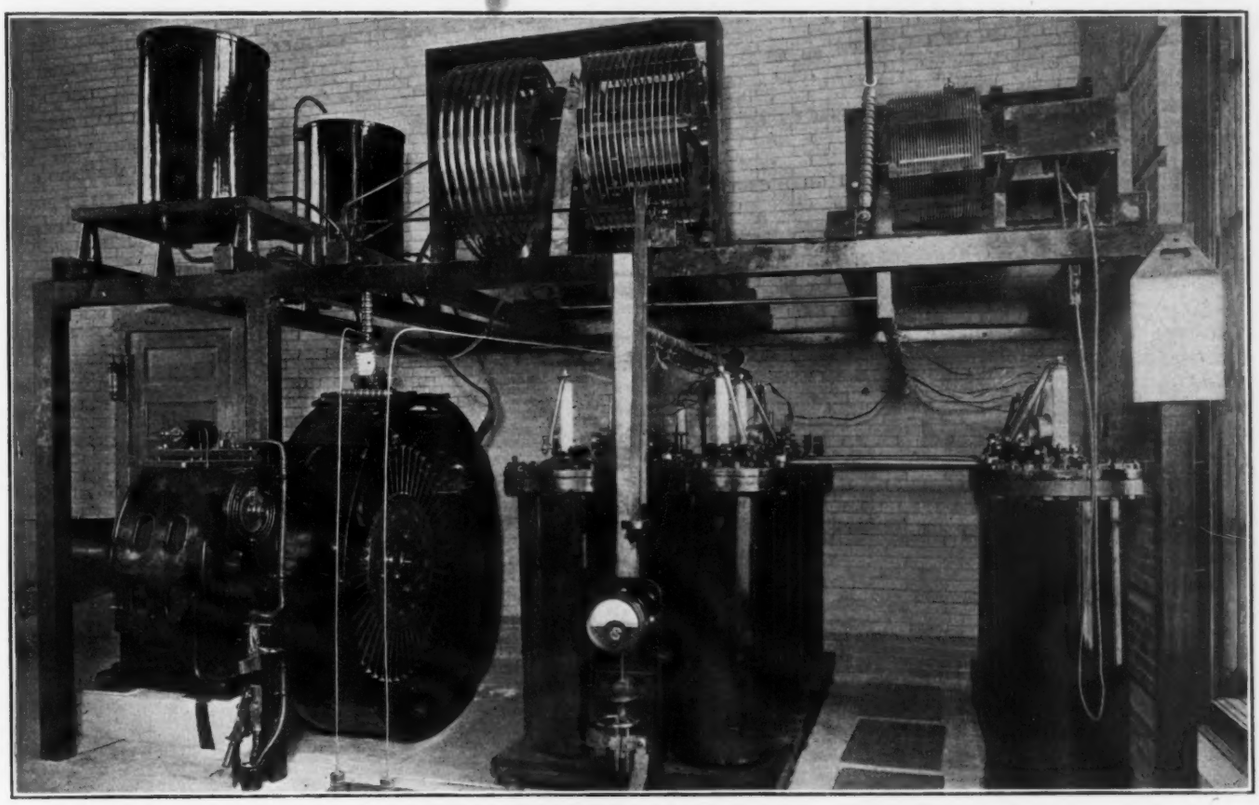


FIG. 4—TRANSMITTING APPARATUS—SYNCHRONOUS ROTARY GAP AND COMPRESSED-AIR CONDENSERS

"SALEM" EQUIPMENT

The equipment on the cruiser *Salem* consisted of the usual type of antenna supported on spreaders carried from insulators attached to the tops of the masts. This antenna was 160 ft. long and 40 ft. in spread. The sending equipment consisted of a 10-kw General Electric motor-generator set delivering 500-cycle, single-phase current to a transformer which raised the emf to 12,500 volts to charge compressed-air condensers which were discharged, by means of a synchronous rotary gap, through oscillation devices for energizing the antenna. All of these devices were of the same type as that employed at Arlington, previously described. This equipment has been in service in the navy since 1909 and was supplied by the National Electric Signaling Company as part of the same contract on which the apparatus installed at Arlington was supplied. The receiving apparatus on the cruiser *Salem* is a duplicate of that employed at the Arlington station.

THE TEST

The actual operation of the radio equipment during the test was in charge of the engineers of the contractor, the operators being supplied by the contractor also. The messages transmitted were, however, supplied by the navy officer in charge of the station and by the captain in the case of the ship. These messages were in most part news items, the ones from Arlington being taken mostly from the daily press and consisting largely of reports of the wars in Turkey and Mexico, while those from the ship were reports regarding progress of the ship, weather reports, reports of derelicts, and finally, when nearing the 1000-mile point, poetry. The fact that Mexican and Turkish names were successfully transmitted in a large number of these dispatches from Arlington should be sufficient proof of the accuracy of the transmission and of the severity of the test.

The cruiser *Salem* left the League Island Navy Yard on Feb. 15 bound for Gibraltar for the sole purpose of conducting radio-telegraphic tests, and primarily for the test of the apparatus described above.

The test arrangements provided for following schedules: Arlington to call the *Salem* and send test D's and dashes for fifteen minutes, starting at 7 o'clock; then, without waiting for reply from the ship, to send four messages supplied by the officers in charge of the station and averaging about thirty words each, these messages to be repeated not more than three times. Then the *Salem* at 8 o'clock started send-

[2]U. S. patent 793,777; applied for March 30, 1905; issued July 4, 1905.
[3]U. S. patent reissue 12,115; original application filed April 9, 1903; reissued May 26, 1903.
[4]U. S. patent 950,781; March 1, 1910.
[5]U. S. patent 1,050,728; issued Jan. 14, 1913, on application filed July 27, 1905.

ing D's and dashes for fifteen minutes, at the end of which she sent four messages supplied by the ship's captain. This program was carried out twice a day, being repeated in the afternoon between 1:30 and 3:30. An additional schedule was run in the evening for the convenience of the engineers in immediate charge of the test, but this had no effect on the official test. The official distance of transmission was taken as the greatest distance at which a successful transmission of all four messages was accomplished without the failure of any intervening schedule. A condition of the test designed to provide for possible emergencies allowed it to continue without prejudice in the event of failure to receive one schedule, provided the next three schedules were received at the same distance.

An idea of the currents received can be gained from microammeter readings taken in the early part of the test. When the *Salem* was approximately 240 miles away in the Arlington receiving apparatus there was 7 micro-amp in the receiving telephone circuit, while in the *Salem's* there was approximately 35 micro-amp. The signal received at Arlington at this point was about 1200 times as strong as one at the limit of audibility.

Arlington succeeded in receiving all messages sent from the *Salem* until 1000 miles was exceeded. Subsequently, after the lapse of one schedule only, all messages were received from 1300 miles. In view of the 1000-mile transmission fully meeting the guaranteed range, no effort was made to establish the higher limit of 1300 miles. It is quite probable that that distance could have been worked successfully as the limit of reliable communication if the attempt had been made. The signal received from the *Salem* at the 1000-mile point of the test was approximately twenty times as strong as required for mere audibility, and by employing the heterodyne it was easily read by two operators simultaneously, each with a separate pair of telephones. The signal received by the *Salem* at this point was 500 times as strong as the minimum audibility signal. The *Salem* succeeded in receiving all messages sent from the Arlington station until 2375 miles had been passed, after which such communication as was had was too feeble and unreliable to meet the full requirement of continuous communication ability.

The transmission distances by night were considerably in excess of those secured during the daylight hours. The *Salem* was able to copy messages until she was very nearly across. In fact, she was able to hear, but not copy, Arlington when lying in the harbor at Gibraltar. The night messages sent from the *Salem* were read without difficulty up to approximately 1600 miles and parts of messages were read at distances up to approximately 2200 miles.

When account is taken of the test conditions under which were determined the daylight limits of reliable communication, of 1000 and 2375 miles for the *Salem* and Arlington stations respectively, one realizes that something out of the ordinary has been accomplished in radio-telegraphic working. This test eliminated the freak transmissions, such as are quite frequently reported in the daily press, and the limits set do not by any means indicate what may be accomplished under particularly favorable conditions. An indication of what may be looked for along these lines is given by the recently reported performance of a set at Key West, of the same make but of only about one-quarter the rating, which was heard one night recently at Cairo, Egypt, some 7000 miles away.

It is difficult to estimate the value of such a station to the government. It has many uses, such as sending out at regular times warnings of storms, derelicts, icebergs, etc., and time signals for the ships at sea. In addition to these, the Navy Department has enormously increased its control of the war vessels, as it can issue orders that can be dispatched immediately to every point within a range of 2400 miles and at night to a distance considerably greater than this.

Application of Motors in Mining and Mill Installations in Colorado

By W. J. Canada

In an article on "Electricity in Metal Mining in Colorado," which appeared in the Dec. 7, 1912, number of the *Electrical World*, the wide application of electricity for driving hoists, pumps, drills, fans, railways and in various processes directly connected with the recovery of precious metal from ore was described at length. In the present article are incorporated data on a number of actual installations in Colorado, the motor equipment of the various departments being given in tabular form with other information.

TABLE I.—THE COLBURN MINING & MILLING COMPANY, VICTOR, COL.

Shaft house, cyanide mill and auxiliary buildings, producing and reducing gold ore at as low values as $2.50 per ton; capacity mill, 300 tons ore in twenty-four hours; four mine motors, rated at 57 hp.; eleven mill motors, rated at 326 hp; energy, 440-volt, 31-cycle, alternating-current, three-phase.

Department	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours Operation.	Monthly Average, Kw-hr.	Five-Minute Peak, Hp. Installed, Per Cent.	LOAD-FACTOR. Connected Load, Per Cent.	LOAD-FACTOR. H'rs Operated, Per Cent.	LOAD-FACTOR. 5-Min. P'k, Per Ct.
Crushing	1 Symons No. 5 crusher 1 Symons disk crusher								
Grinding	2 sets rolls 2 large trommels, 12-mesh	1–100	80	6–8	12530	78.3	15.8	46.1	59.1
Elevating	Elevators and conveyors	2–5	6	6–8					
Shaft house (Mine)	40-kw, 125-volt d.c. generator 2 mine locomos., 2 5-hp motors, each 5 hp in blacksmith 10 hp on chain conveyor 10 hp on aerial tram	1–40	40	7–9					
	Assay office, crusher	1–2	1	8–9	2650	98	6.5	19.5	19.8
	Machine shop	1–5	5	8–9					
	Mine pump (emergency.)	1–10	10						
Tube mills	3 5-ft.x15-ft.tube mills			(2) –24					
	32 r.p.m., 60-ton capacity	3–50	155	(1)–12	60560	103.3	56.1	67.2	65.0
Pumps Agitators	1 agitator compressor 1 centrifugal circ. pump					*	*	*	
	3 triplex solution pumps	1–35	50	24					
Reduction	1 tailings hoist	1–7½	8	24	37010	136.5	121.0	121.0	88.8
	1 assay crusher, grinder zinc feeder	1–2	2						
	1 blower tilting furnace	1–1	1						
Electrolysis	1 10-volt double G.E. generator, 1500 amp. (Twenty days' operation per month of period averaged)	1–20	20	24 (‡)	7974	100	55.3	83.0	83.0
Lighting mine				10–16	2318				
Lighting mill				10–16	1775				
Total load†	Mine and mill	14–383	371 Av. 3 mo.	Various	125817	96.9	61.1		63.0

*Omitting 2 small.
†Twenty-four-hour basis.

ADVANTAGES OF ELECTRIC DRIVE.

From the mine and mill standpoints, which are usually combined in successful ventures by erecting the mill near

the mine plant, the advantages of electric drive apply to many of the most important features. A saving is generally effected in first cost by the possibility of power division, making it feasible to avoid costly installation, operation and maintenance of line shafting and belting, and a ready increase in economy has been effected in several cases by changing to motor drive, assuring constant speed for mills, pumps, tables and feeds. The unified plant provides the further advantages of convenience and possibility of ready repair of motors, enabling all of the attention of the miners and mill hands to be given to the real work of getting out the ore and treating it to recover the metals in paying quantities. In addition to these operating advantages, the considerable decrease in the fire-insurance premiums of the well-wired electrically driven mine compared with those of the steam-driven mine may be cited as a saving not to be overlooked.

The sole disadvantage pointed out against the electrically driven mine has been that it is more liable to sudden breakdown due to failure of some part of the system than is one run from a private steam-driven plant. This is still used as an argument against electrical operation in sinking shafts.

TABLE II.—THE PORTLAND GOLD MINING COMPANY, VICTOR, COL.

Cyanide mill and auxiliary buildings, handling profitably ores as low as $2.50 per ton; capacity, 700 tons ore in twenty-four hours; 24 mill motors, rated at 1050 hp; energy, 440-volt, 31-cycle, alternating-current, three-phase.

Department.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours' Operation.	Monthly Average, Kw-hr.	Five-minute Peak, Hp. Installed, Per Cent.	LOAD-FACTOR. Connected Load, Per Cent.	LOAD-FACTOR. Hours Operated, Per Cent.	LOAD-FACTOR. Hours Operated, Per Cent.
Crushing	Crushers, rolls, trommels....	1–150	110	16		73.3			
Conveying	2 conveyors...	1–20 1–10	11.5 2.7	16		47.2			
Sampling	Sampling crusher and grinder.....	1–15	6.2	16		41.3			
Milling	4 Akron Chilean mills.....	1–300	300.0	24		100.0			
Concentrating	Card and Wilfley tables....	1–15 1–30	7.2 18.8	24		57.7			
Classifying	Classifiers.....	1–15 1–20	17.0 18.0	24		100.0			
Tube mills	2 5-ft.x16-ft. mills.....	1–60 1–60	45.0 45.0	24		37.5			
Lime pump	1 pump.....	1–15	5.4	2		36.1			
Agitating	Air agitators, compressors..	1–20 1–20 1–15	23.0 25.0 8.6	5 5 24		115.0 125.0 57.3			
Filtering	Pumps and press.....	1–10	3.8	24		38.0			
Precipitation		1–15	2.1	24		14.0			
Solution pumping	Pumps.....	1–20 1–15 1–15	15.0 11.8 9.7	24 24 24		75.0 78.5 64.6			
Filter vacuum	Vacuum pump Solution pump	1–40 1–15	23.0 11.5	24 24		57.4 76.5			
Air compressor		1–50	25.0	24		50.0			
Tramways	75-kw, 125-volt d.c. generator..... 5 2-motor locomotive, crane type, 10-hp.. Third-rail on ties between tracks. Ore mine to mill to dump.	1–100	28*	24	20200		28.0	28.0	
Lighting	Mill and grounds.....		10kw.	10–16					
Total load	Mill and auxiliary buildings	24–1050	550 kw.	Various	320000	70.3	57.8		80.8

Load-factor—Five-minute peak, twenty four hours.

*Average for day.

MINING AND MILL INSTALLATIONS.

As samples of highly desirable load conditions in metal reduction mills the condensed notation contained in Table I may be of interest. The mill referred to in this table has been operated under rather adverse conditions since its recent installation. A sample day in April, 1912, under more favorable operating conditions, shows a five-minute peak of 225 kw, a minimum of 190 kw and an average of 200 kw for twenty-four hours. The readings were taken with recording instruments. The energy is supplied by the Arkansas Valley Railway, Light & Power Company to three 100-kw, 24,000/440-volt transformers, which are placed in the reinforced-concrete substation of the Colburn Company. Graphic meters are installed which record the total load and the load of each department, and the daily readings of these meters are tabulated by the plant electrician.

TABLE III.—THE PRIMOS MINING & MILLING COMPANY, LAKEWOOD, COL.

Tungsten wet concentration mill handling ores carrying from $10 to $500 per ton in tungsten acid; capacity, 40 tons per twenty-four hours; eight mill motors, rated at 130 hp; energy, 440-volt, 25-cycle, three-phase.

Department.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours' Operation.	Monthly Average, Kw-hr.*	Five-Minute Peak, Hp. Installed, Per Cent.	LOAD FACTOR. Connected Load, Per Cent.	LOAD FACTOR. Hours Operated, Per Cent.
Custom Sampling	1 7-in.x10-in. 30-ton crusher, belted, 280 r.p.m.....	1–10	8	1–8		80.0		
Crushing	1 9-in.x15-in. 75-ton crusher, 240 r.p.m. 1 samp. crush., grind.....	1–15 1–5	12 2	5 Av. 1–5		80.0 40.0		
Stamps	2 batteries, 5-hp each, rated 50 tons, 90 r.p.m.....	1–35	25	24		71.3		
Concentrators	2 Wilfleys, 1 Frenier, 240 r.p.m.....	1–5	4	24		80.0		
Vanners	3 6-ft. 8 4-ft. vanners, 210 r.p.m.....	1–10	10	24		100.0		
Tube mill	1 Krupp 6-ft.x 8-ft. tube mill 40 r.p.m..... 3 Frenier sand pumps.	1–35	22	24		62.5		
Circulating pump	1 300 g.p.m. No. 70 centrifugal, 1000 ft. distant on creek.....	1–15						
Lighting	160 lamps, 16-cp.....		8	10–16				
Total load	Mill and auxiliary buildings	8–130	64	0–24	31000	48.2	44.4	90.2

Twenty-four hours average. Five-minute peak.

*Not metered separately for different departments.

In July, 1912, the mill of the Portland Gold Mining Company at Victor, Col., referred to in Table II, in treating 15,003 tons of ore consumed 325,400 kw-hr. and showed as its greatest five-minute peak 545 kw., indicating a load factor of 83 per cent. Energy is supplied to the steel substation of this company by the power company mentioned

above, and it is taken directly through the six 100-kw transformers which are protected by electrolytic lightning arresters to recording instruments arranged in the same fashion as those just described. The power-factor at this plant averages 87 per cent.

The mill of the Primos Mining & Milling Company at Lakewood, Col., treated approximately 1100 tons of tungsten ore in July, 1912, with a maximum demand of 55 kw, a minimum of 37 kw and an average of 43 kw. The chief cause for the variation was the 8-kw crusher load, but this never occurs during the 6-kw lighting peak. The Central Colorado Power Company furnishes energy at 13,000 volts and 25 cycles to the substation of the Primos company, where it is stepped down to 440 volts for motor circuits and 110 volts for lighting purposes. Data from this mill are given in Table III.

TABLE IV.—THE WOLF TONGUE MINING & MILLING COMPANY, NEDEVLAND, COL.

Tungsten wet concentration mill handling $10 to $500 ores; capacity, 10 to 12 tons per ten-hour day usually run; largely custom mill; three mill motors, rated at 130 hp; energy, 440-volts, 25-cycle, three-phase.

Department.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours' Operation.	Monthly Average, Kw-hr.*	Five-Minute Peak, Hp. Installed, Per Cent.	LOAD FACTOR. Connected Load, Per Cent.	LOAD FACTOR. Hours Operated Per Cent.
Crushing	1 7-in.x10-in., 1 6-in.x8-in. crusher	1–50	30	3–8		60.0		
Grinding	1 set 14-in.x27-in. rolls, 120 r.p.m. Conveyor, elevator, sampl. crusher and grinding.							
Trommels	1 6-ft.x3-ft. trommel ¼-in. mesh	1–15	15	8–11		100.		
Jigs	1 6-ft.x3-ft. trom.12-mesh 2 2-ft.x3-ft.jigs and feeders							
Stamps	4 5-stamp batteries, 90 r.p.m. 2 Frenier sand pumps.	1–35	30	8–11		86.0		
Tables	2 Monnell classifiers. 1 centrifugal pump 5 card conc.tab 260 r.p.m. 1 Wilfley conc. tab, 245 r.p.m 3 Monell Slimers 260 r.p.m.							
Dryer	1 12-ft.x6-ft. brick dryer....		20					
Total load	Mill building..	3–100	65	0–11 25 days per mo.	10,200	65.0	18.9	84.0

Average load-factor—Twenty-five days, ten hours. Five-minute peak.

*Not metered separately for different departments.

Another mill handling tungsten ore and obtaining its power from the same source as the Primos company is the Wolf Tongue Mining & Milling Company, of Nederland, Col., which is referred to in Table IV. This mill has in connection with the electrical drive a private steam plant for use during the winter months and as a producer of emergency power. This emergency plant is installed in a concrete building and consists of one 80-hp return-tubular boiler, one 150-hp Chuse high-speed engine, one 150-hp Leffel waterwheel, one 125-kw, three-phase generator and one three-panel switchboard fitted with necessary accessories. The generator may be connected to either the engine or the waterwheel by an interlocking clutch, the connection to the waterwheel being direct and that to the engine through a belt. The supply to the waterwheel is under a 70-ft. head but is unavailable during two months of the year owing to extreme cold weather. Data gathered from the operation of this mill are given in Table IV.

DEVELOPMENT OF THE CRIPPLE CREEK DISTRICT.

The foregoing data establish the fact that a mining and milling load is a highly desirable addition to the business of a central station. In the Cripple Creek mining district, which comprises about 18 sq. miles and is devoid of water-power, this industry has been developed as it has in no other place in the country. When this district was discovered in 1891 the population jumped to 50,000 inhabitants, but this has recently decreased owing to the application of intensive operation of the mines as opposed to the old and wasteful methods. The total value of production remains nearly constant at $1,200,000 a month, but the grade of ore now handled is very different from that of former times, the value running less than $3.50 per ton now, when formerly $300 per ton was obtained from some of the mines. The amount of ore now mined monthly in the district averages 80,000 tons, and the average value is $15 per ton. Approxi-

TABLE V.—CRIPPLE CREEK DISTRICT ELECTRIC INSTALLATIONS.

Location.	TRANSFORMERS. No.	Kw.	Volts.	No. Motors.	Hp. Rating Motor	Applications.
Ark. Val., Victor substation	3	300	24000= 6600= 2300			6600 volts to small mines near Victor, 2300 volts to lighting Victor and Goldfield.
Ark. Val., Bull Hill substation, 100% P.F. Syn. Cond.	3	200	24000 6600			6600 volts to small mines near Bull Hill.
Ark. Val., Badger substation	3	200	24000 6600			6600 volts to small mines near Cripple Creek.
	3	150	24000 2300			2300 volts to lighting Cripple Creek.
Colburn mine and mill, substation.	3	100	24000 440	15	383	Mine and mill, motor service and lighting.
Independence mill, substation.	3	200	24000 440	22	1070	Mill and mine, motor service and lighting.
Portland mill, substation.	6	100	24000 440	24	1050	Mill only, motor service and lighting (mine on 6600-volts).
Cameron Ry. substation.	3	150	24000 370	Rotaries	600	Operate Cripple Creek high and low line electric railway.
Anaconda mine.				4		
Blue Flag mine and mill.				6		
Copeland sampler.				3		
Crescent mine...				5		
Drainage tunnel.				4		
El Paso mine and mill.				5	160	15 hp mach., 15 hp bl. sm., 30 hp. washer, 25 hp fan, 75 hp—.
Elkton mine and mill.				2		
Eagle sampler.				3		
Findley mine and mill.				6	224	175 hp compres. 30 hp hoist, 2 hp assay, 5 hp washer, 10 mach.
Golden Cycle mill.				4	110	85 hp mills, 15 hp trans. gen., 5 hp convey, 5 hp convey.
Vindicator.				8	214	10 mach., 175 hp compres., 5 hp assay, 1 hp bl. sm., 10 hp convey., 10 hp washer.
Miscellaneous.				90		
Total installation, July, 1912	27	4500	24000= 6600 2300 440 370	201 +	7800 hp 5820 kw.	Town lighting omitted. All railway, motor, and mine and mill lighting included. Kw-hr. metered: April, 1,397,440; May, 1,383,150; June, 1,171,114; Monthly average, 1,317,234. Daily, 1830.

Average hp demand per installed transformer hp	0.407
Average hp demand per installed motor hp	0.315
Maximum five-minute peak at 9-10 a.m. (no lighting load), kw.	2900–3000
Maximum five-minute peak at 7-8 p.m. (no mine load), kw.	1900–2200
Load-factor, twenty-four-hour, on basis five-minute peak	0.62
Motor hp installed per substation hp	1.29
Motor hp installed per inhabitant district	0.65
Motor hp installed per square mile served	433
Yearly kw-hr. demand (motor service) per inhabitant district	113.17

mately one-third of this is now hoisted electrically, and about the same amount is treated in the electrically driven mills of the district, which are operated twenty-four hours a day and vary not over 20 per cent from the average load. The load factors of the stations of this district are now increasing owing to the increasing load from the mills and the decrease in the lighting load of the towns, due to decrease in population.

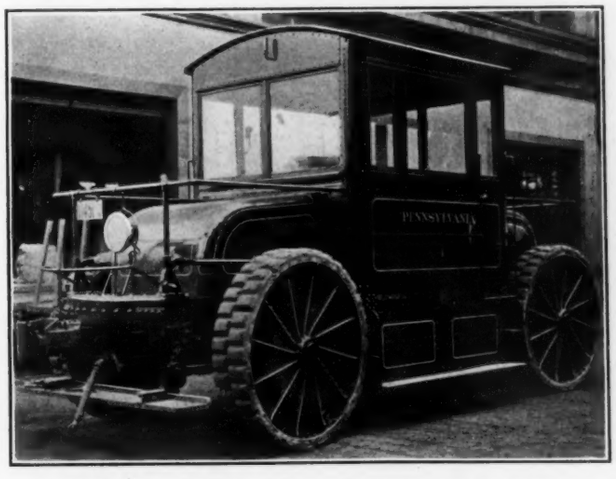
The decrease in the lighting load is not at all alarming inasmuch as the increase in the use of electricity in the past five years has amounted to 100 per cent and during the year of 1911 an increase of 20 per cent was made in the district. Formerly this load was carried by the Colorado Light & Power Company of Canon City and the Suburban Traction & Lighting Company of Pueblo, with a steam plant at Pueblo and a hydroelectric plant at Skaguay. But during the past year these two companies have been taken over by the Arkansas Valley Railway, Light & Power Company, and all of the power stations are now interconnected with 24,000-volt transmission lines.

These lines enter the main substation of the Arkansas Valley company at Victor at 24,000 volts, and there the tension is stepped down to 6600 volts for local distribution to the substations of the various mining companies. At the various company substations a second transformation takes place and the energy goes to the motors at 440 volts. The primary lighting circuit which serves the city of Victor is operated at 2300 volts and the secondaries carry a potential of 110 volts.

Metal mining, especially gold mining, is an industry which is marked in the public mind because of its instability. But the recent installations of permanent mills where large though low-grade ore bodies are available tend to offset this general opinion. A glance at Table V, which is a tabulation of the electrical installations in the Cripple Creek district, will show what an important factor electricity is in this development.

Battery-Driven Tractor for Switching Freight Cars in City Streets

What has been aptly designated as "the most powerful electric automobile ever built" is now in the service of the Pennsylvania Railroad at its Jersey City yards for moving



BATTERY-DRIVEN TRACTOR OF PENNSYLVANIA RAILROAD

freight cars through city streets where locomotives are not available or desirable. This 14-ton tractor is arranged to run on the ground, the 7-ft. tread of its rubber-tired wheels easily spanning the standard track. The car can thus be maneuvered around an ordinary train, since its movement is not confined to the rails. A normal drawbar pull of 8000 lb. is developed, which can be increased to a maximum of 21,500 lb if required. Running light, the tractor maintains a speed of about 6 miles per hour.

Energy for the two 20-hp General Electric motors is supplied by eighty cells of Edison A-12-H storage battery, weighing 4350 lb. Herringbone gears connect the motors to the countershafts, a total reduction of 1 to 40 being obtained at the wheelshafts. The tractor utilizes all four wheels for driving, steering and braking. With this arrangement the car can be turned in a circle of 20-ft. radius. By means of duplicate equipment in the cab the tractor can also be operated in either direction from either position. Compressed air actuates the internal expanding brakes in the four wheels. An arrangement of interlocks prevents the controller being operated to turn on power while the brakes are set. Through standard hose connections compressed air is also supplied for braking the freight cars.

In over-all length, including the M. C. B. couplers with which the tractor is equipped, it measures 23 ft., 19.5 ft. of which is the chassis. The wheelbase distance between the 5-ft. rubber-block-tired wheels is 12 ft., the gage being 7 ft. The over-all width of the machine is 8 ft. 4 in. and the height 11 ft. 3 in. The tractor, which weighs 28,850 lb., was built in the Altoona (Pa.) shops of the Pennsylvania Railroad. While being tested at Altoona it successfully bucked one of the largest steam locomotives in the Pennsylvania's service, moving three freight cars against the traction of the locomotive with wide-open throttle.

Electromechanics Research Laboratory at Columbia University

By J. H. Morecroft

Through the generosity of an anonymous donor the department of electromechanics of Columbia University received recently the sum of $20,000 for much-needed equipment to carry on research work along various lines in the field jointly occupied by physics and electrical engineering. Below is given a brief description of the new apparatus installed in the laboratory together with an outline of the research work for which the laboratory is suited.

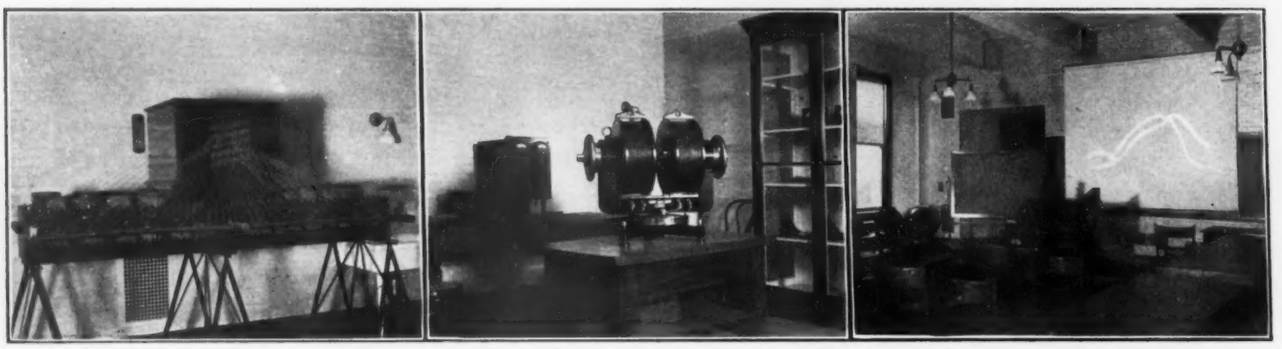
The laboratory, which is under the directorship of Prof. M. I. Pupin, occupies the complete basement of the Philosophy Building. All the rooms are well lighted and finished and form pleasant workshops for the research students. In addition to the office of the director there are two very large research rooms and two smaller rooms for the same purpose, a well-equipped machine shop, a lecture room in which are models, demonstration apparatus, etc., and a photographic dark-room. The machine shop is equipped with modern motor-driven tools for working metal and wood and is used exclusively for construction of such special apparatus as cannot be bought. Anyone familiar with research work can appreciate the value of this shop to the research student; he frequently needs some piece of equipment which is of a special kind and not on the market but which can generally be quickly built with proper tools and equipment by a skilled mechanician.

Each research room is equipped with a switchboard panel from which 110-volt or 220-volt energy is available, either direct current or 60-cycle alternating current. In addition to this source of energy many small motor-generator sets are available. These can be transported from one room to another, so that the motor-service facilities are excellent. Constant speed is obtained either by synchronous motors or by direct-current motors driven from a storage battery with tuning-fork regulator. By this means the speed of a motor may be held constant within less than 0.02 per cent.

For alternating-current work it is necessary to have available a wide range of frequency. From various alternators in the laboratory it is possible to obtain currents of any frequency from a few cycles per second up to 200,000 cycles per second. With the upper frequencies experiments

on so-called wireless telephony and telegraphy may be readily carried out and such things as skin effect, hysteresis at high frequencies, etc., may be investigated.

As much of the work carried out in the past in the laboratory has had to do with wave transmission, it is natural to find here proper facilities for the examination of wave phenomena. Telephone cables, real and artificial, loaded and unloaded, artificial ocean cables and energy-transmission cables are at hand, and the student interested in this line of work can carry out nearly any conceivable test in the field. A section of loaded telephone cable is shown in Fig. 1; the loading coils may be inserted or removed at pleasure and the resistance of the line can easily be varied to illustrate the comparative effects of loading.



FIGS. 1, 2 AND 3—LOADED TELEPHONE CABLE, POWERFUL WEISS ELECTROMAGNET AND A PROJECTING OSCILLOGRAPH

A General Electric oscillograph, with three vibrators mounted on a movable table, can be taken from one room to another. This is, of course, the instrument relied upon for the experimental study of most transient phenomena. The laboratory is also equipped with a Siemens & Halske projecting oscillograph, which is used for lecture demonstration. A view of the lecture room showing this oscillograph and some wave-forms thrown on the screen is given in Fig. 3, the wave-form on the screen is plainly visible over the whole lecture room.

For investigating the effect of a magnetic field on light waves a very powerful Weiss electromagnet has been obtained. This magnet, shown in Fig. 2, produces a flux density in the air-gap up to 100,000 lines per sq. in. The very heavy currents necessary to give this flux density generate so much heat in the field coils that it is necessary to have them water-cooled. A calibrated bismuth spiral is used to measure the flux density.

The laboratory is well equipped with condensers which are required in many experiments in electromechanics. For constant use on a 100-volt alternating-current line there is available a condenser of 500 mf capacity; for continuous use on a 750-volt line there is a 400-mf condenser, and for continuous use on 2000-volt lines a 40-mf unit. This latter condenser, made of mica, has sufficient capacity to load a 60-kva, 60-cycle alternator to its full rating.

The high-frequency General Electric generator is shown in Fig. 4. It was designed to have a full load of 1 kva at 200,000 cycles per second. It operates at a speed of 20,000 r.p.m. and its rotating member has a peripheral speed of about 12 miles per minute. The high-speed bearings are equipped with forced-feed oiling as may be seen in Fig. 4. Many very surprising effects are noticeable at once when working with currents of this frequency; for example, an ordinary alternating-current voltmeter reads only 20 volts when connected to a 100-volt, 200,000-cycle line. The inductance of the meter, negligible for ordinary frequencies, becomes so great at these high frequencies that its reading is only about one-fifth of what it should be. This error is different at different parts of the scale so that ordinary alternating-current meters are not at all suitable for these frequencies; hot-wire or static instruments must be used.

In addition to the special pieces of apparatus noted in the preceding paragraphs, there are numerous variable inductors, resistors, galvanometers, etc., for ordinary measurements. Vibrating galvanometers for frequencies from 15 cycles to 2000 cycles per second, frequency meters, direct-current galvanometers with extreme sensibility, alternating-current ammeters with ranges from 6 milliamperes up and other apparatus of similar nature make the experimental equipment very complete. One of the research rooms is shown in Fig. 5. In the work at present being carried out one experiment may require apparatus occupying practically a whole room. Such is the experiment for which Fig. 5 shows the arrangement of apparatus; the running characteristics of an induction generator are being determined by Wheatstone-bridge measurement.

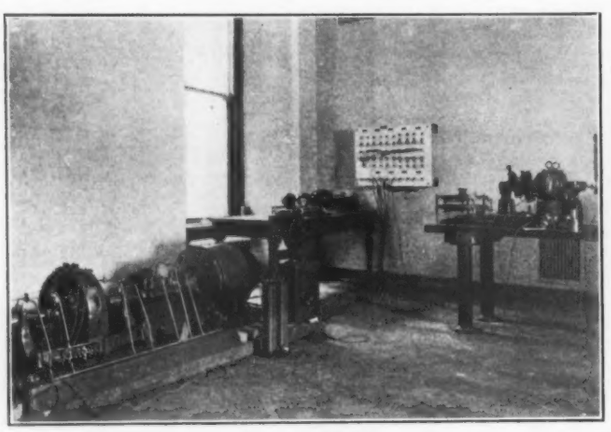


FIG. 4—HIGH-FREQUENCY GENERATOR

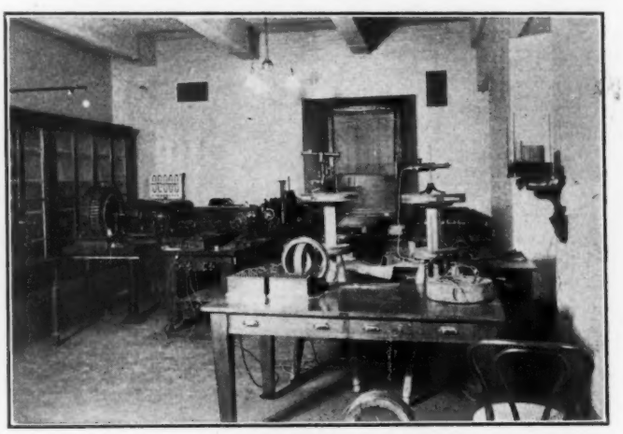


FIG. 5—APPARATUS FOR TESTING AN INDUCTION GENERATOR

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

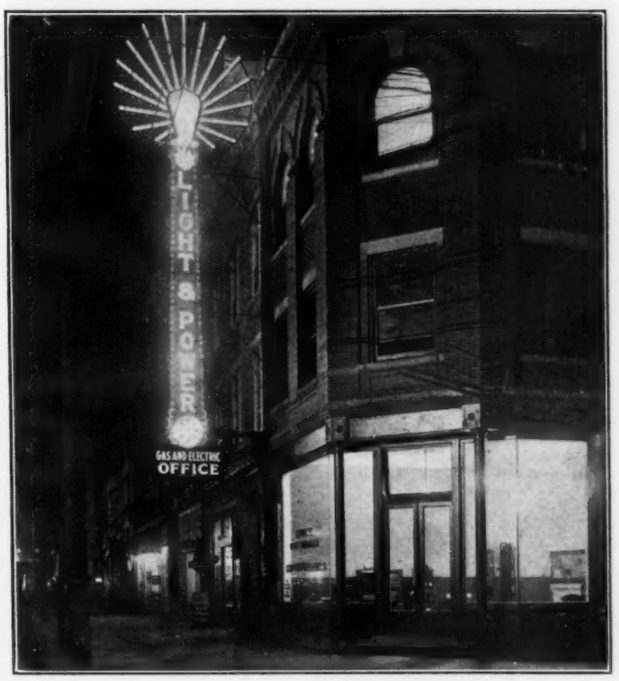
Ice Manufacture a Good Revenue Getter

After having operated a 3-ton ice plant in connection with its electrical generating station, an Illinois combination company serving a town of 2500 is now installing an additional 12-ton freezing outfit, bringing its total ice-making capacity up to 15 tons per day.

"We consider the ice proposition a good revenue getter," declares the manager, "and would advise all central stations located in small towns to go into it, provided they can find a market for the product."

Central-Station Office at Newport News, Va.

The accompanying illustration shows a night view of the 39-ft. sign in front of the Newport News office of the Newport News & Old Point Railway & Electric Company, Hampton, Va. The sign contains 842 4-cp, 5-watt tungsten lamps operated by a flasher. The outer row of lamps is colored red and represents a belt which passes around a pulley at the bottom and a motor shaft at the top. Surmounting the whole is a representation of a large incandescent lamp from which rays of light flash at intervals. The words "Light & Power" remain lighted continuously.



A 39-FT. CENTRAL-STATION SIGN

The sign and the office in front of which it is placed make the most brilliantly lighted spot on the main street of Newport News, and advantage is taken of the publicity thus secured to display within the office all kinds of electric household devices as well as gas appliances. The window displays are changed twice a week, but the showcases inside and the set pieces of apparatus are not disturbed. Large plate-glass windows on the two streets make everything within the office visible by day or by night. Mr. F. B. Lawton is head of the gas and electric department of the company.

Ice Plant Was "a Financial Life-Saver"

"We have found our ice plant to be a financial life-saver," declares an Arkansas central-station operator who has been running his ice machine twelve years with a total expense for repairs of only $50. Last season he made 400 tons of ice with his 6-ton outfit. His 50-lb. renewal of anhydrous ammonia cost $16.11, and barring a leaky joint or accident, enough is left to make the entire 1913 season's run.

The ice machine is operated only during the night, as the electric plant at present furnishes no day service. During the present season it is planned to inaugurate twenty-four-hour operation of both the ice and electric plants. Arrangements for ice storage will be made, and the company will cater to the out-of-town trade. Until the present it has contented itself with the local business, which during the four-month operating season demands about 400 tons of ice. The cost of manufacture is estimated at $1.50 per ton. During the year the ice business brings in gross returns of about $3,000.

Courtesy from Employees and Public

The wise utility company of to-day overlooks no effort to establish a better feeling between the public, its employees and itself. One of the ways of bringing about this desirable co-operation is the use of placard announcements setting forth in earnest language the company's policies.

Following is the text matter appearing on a number of "courtesy cards" that have been distributed among the properties operated by the Federal Light & Traction Company of New York, the local company's corporate name in each case appearing at the bottom of the placard:

THE PUBLIC IS ENTITLED TO COURTEOUS TREATMENT AND TO THE BEST POSSIBLE SERVICE

Courtesy is the most valuable asset that an employee of this company can possess. The best efforts of the company to please its patrons are sometimes offset by the thoughtlessness of an employee who may fail to remember that any act of his which develops ill feeling reacts upon the company and upon his fellow employees.

TO OUR EMPLOYEES:

Courtesy is the outward expression of breeding and character.

Don't forget that you are in the service of the public as well as of the company. Never attempt to take advantage of a patron. The company wants no revenue it does not earn. This is not a "soulless corporation," and the conduct of each individual employee should so demonstrate.

TO THE PUBLIC:

Please do us the favor of selecting our office as the proper place to register complaints.

We are ready and anxious to investigate any "kick."

No individual or corporation can always be perfect.

We invite your help and ask your co-operation in bettering our service.

"COURTESY CARD" OF A NEW YORK COMPANY

Copies of these cards are being placed over the cashiers' windows of local offices, in the employees' club rooms, in the general offices and demonstration rooms, in show windows, and in the street cars operated by the subsidiary companies.

Ten per Cent Ice-Making Returns in Poor Season

A Tennessee city of 5000 uses 20 tons of ice per twenty-four hours in the heated season, and during the seven-month period of 1912 consumed 3000 tons of the frozen product. The ice plant is operated as an adjunct of the local central station, whose twenty-thousand-dollar ice-making investment is divided as follows:

Ice machine, freezing tank, etc.	$15,000
Addition to building	3,000
Delivery wagons	2,000
Total	$20,000

A useful auxiliary to this station is the 200-ton ice-storage room, which at an additional investment of $1,000 permits the plant to be kept at full-rated output during slack periods, manufacturing ice for the heavy demands of the summer days.

Following is the company's balance-sheet account for 1912, "a poor year, owing to low summer temperatures":

Yearly gross income from ice making	$15,000
Yearly expense (interest, depreciation, etc.)	13,000
Net returns	$2,000

Despite the showing above made, which the company considers as exceptionally low, owing to the poor year, the management feels well satisfied with its ice-making venture.

Profits of a Wholesale Ice Business

In a Western town of 8000, not far from Omaha, the 21-ton ice equipment in the local combination central-station plant is run profitably seven months in the year, producing 2700 tons of ice. For the convenience of the community during the remaining five months it has been the practice to operate the ice machine at reduced output, although at a slight loss.

The total ice-plant investment in this station reaches about $25,000. During one of the average ice-making months of last summer the costs for operation were: Fuel, $524; labor, including office help, $165; supplies, etc., $50.

To produce a ton of ice costs an average of about $2, and this product is sold wholesale to a local dealer at the rate of $3 per ton. The latter retails and delivers it at 40 cents per 100 lb. This sales arrangement is found to be particularly satisfactory, as the plant is assured of a good profit on all its product while being spared the annoyance of conducting a retail business.

Herewith is given the summary of results of last year's operation:

Gross income from ice business	$8,200
Expenses, including interest, etc.	5,200
Net income from ice business	$3,000

On an investment of $25,000 the central station thus earns returns of about 12 per cent, which is added to its other income without particular effort, the work of the ice plant being handled by the regular force of the station.

Electric Incubation at 1 Cent per Chick

Demonstrating that the provedbial "high cost of living" may certainly be reduced through electrical means by the breeding of chickens at 1 cent per chick, the Kentucky Electric Company of Louisville, Ky., recently brought to a close a window demonstration of electric incubators. Just prior to Easter, and twenty-one days after they had been deposited in the warming chamber of a Cyphers incubator, seventy-five of ninety-eight eggs brought forth their downy occupants, the gradual birth of the big brood being accomplished in plain sight of those passing the Electric Building at Fourth Avenue and Chestnut Street. Fourteen kilowatt-hours of electricity and considerable trouble in turning the eggs and cooling them properly were required to produce the brood, and the energy consumed, quoted in "Ky-El-Co" terms, made each chick cost a penny exclusive of the price of the eggs themselves. After the successful hatch had been accomplished by the "electric hen," the Louisville company proceeded to prove that young chickens may be "mothered" successfully in an electric brooder.

Railroad Company a Good Ice Customer

In a Western town with fewer than 3000 inhabitants, situated on one of the transcontinental railroads, a combination ice-electric company has a yearly contract with the railroad company to supply ice for replenishing its refrigerator cars en route. By the terms of this contract the railroad takes all of the surplus ice which the plant can furnish during the summer season. The following data show how great a factor the patronage of the railroad company has been in allowing the plant to operate to its full rated output:

PERCENTAGE OF SALES TO DIFFERENT CLASSES OF CUSTOMERS

Railroad company	62
Wagon and ice book sales	28
Butcher shops	5
Lobby sales	3
Out-of-town customers	2
Total	100

Since retail and wholesale prices for delivered ice are different, it is natural that the gross income was not in proportion to the percentage of ice sold to the various classes of customers. However, considering the smaller cost of wholesale handling and the increased satisfaction which generally results from dealing with one large customer rather than many smaller ones, the following figures show the wholesale trade to be a very profitable one:

PERCENTAGE GROSS INCOME FROM DIFFERENT CLASSES OF CUSTOMERS

Railroad company	36
Wagons and ice book sales	48
Butcher shops	7
Lobby sales	6
Out-of-town customers	3
Total	100

The maximum rated output of this busy plant is 10 tons of ice per day. During its season of eight and a half months 1967 tons of ice were made. Adopting a sliding scale of prices, ice was sold in wholesale lots at a figure varying from $3 to $4 a ton, and the retailed product was delivered at a cost to the consumers of from $8 to $10 a ton.

Details of the expense of producing a ton of ice and delivering it when operating under these conditions, as estimated by the manager of the company, are given below:

COST OF PRODUCING AND DELIVERING 1 TON OF ICE

Fuel	$1.270
Labor, including clerical work	0.860
Water	0.080
Oil	0.050
Ammonia	0.060
Light	0.150
Supplies	0.190
Insurance on plant	0.025
Interest on investment	0.320
Depreciation	0.400
Delivery	0.525
Total	$3.930

The total investment carried by this plant at present amounts to $11,000, and during the season of 1912 a net earning of $1238, or a little over 11 per cent, was shown. Depreciation for the entire station and equipment is calculated each year according to the rate prescribed by the public utilities law in the state where it is located.

Teaching the Customer the Cost

At Manchester, N. H., the central-station display windows recently contained a number of electrical appliances arranged to rotate about a Donkin cent-hour meter with which the devices were successively connected. A dummy figure winked its eye and indicated each appliance as it was being measured by the meter, which showed directly the cost in cents per hour to operate the given device.

Many customers were observed to stop in front of the window and note down on memorandum pads the cost of running the various devices. Some would watch the whole operation through twice, checking the second reading to see if it corresponded with the first. The local company has also made successful use of moving-picture displays in its windows.

Electric-Vehicle Cost Data

At a meeting of the Electric Vehicle Association of America recently held in New York President Arthur Williams announced that the New York Edison Company has under way comprehensive plans for the establishment and maintainance on a co-operative basis of an electric-vehicle garage in New York City. A complete road map showing the charging stations now extant is being prepared by the New York Edison Company and will be available within a few weeks. This map covers all territory within a radius of 100 miles of New York.

Before introducing the speaker of the evening, Mr. L. T. Gerson, garage manager for the John Wanamaker store, was called upon to outline the electric-vehicle campaign which that store is about to launch. He stated that it is the intention to sell cars upon three different plans, namely, to sell the cars outright, to sell the cars and include in the purchase price one year's complete garage service at any garage designated by the purchaser, or to sell the cars and include one year's private garage service. It is thought that these plans will overcome the greatest obstacle now encountered by the salesmen of electric vehicles, that is, the hesitancy of the prospective customer caused by the lack of garage facilities.

The paper of the evening, presented by Mr. H. F. Thompson, of the Massachusetts Institute of Technology, reviewed the work of the electrical engineering department of that institution in the collection and preparation of comparative cost data on the operation of horse, gasoline and electric vehicles. Articles descriptive of the methods used and results obtained from time to time appeared in the *Electrical World* on April 6, 1912; May 18, 1912, and Dec. 14, 1912.

In addition to results from tape records from numerous vehicles, several very interesting estimates on delivery costs in five classes of business were given, based upon previous data. A summary of these estimates is shown in the accompanying tables.

From these comparisons it will be noted that for the light cars the superiority over horse wagons in suburban service is very evident. This is work in which hauls of considerable length exist between the points of loading and the beginning of distribution. In a limited territory, such as within a 4-mile radius of a loading point, the superiority of the motor cars over horse wagons increases to a marked extent with the size of the load.

The above conclusions are not applicable to all classes of work but only to those cases where the characteristics are similar to the assumptions upon which the estimates are based. The specific services selected are particularly suited for electric trucks. Other services in which the distances traveled per day are in excess of 45 miles would in many cases show a decided advantage in favor of the gasoline truck, while for very small daily distances, 15 miles or less, the horse wagon would undoubtedly prove the cheaper. It must, however, be borne in mind that service requirements are as important a factor in determining costs as in the type of the vehicle selected.

The discussion following the presentation of the above paper was participated in by Messrs. F. S. Gasaway, W. P. Kennedy, E. W. Curtis, Jr., R. M. Lloyd, J. C. Bartlet, S. G. Thompson, E. C. Roberts, H. M. Martin and W. E. Holland. In closing the meeting President Williams announced that the next meeting would probably be addressed by a representative of the teamsters' union.

ESTIMATE FOR SUBURBAN PARCEL DELIVERY

	1,000-lb. Electric	1,000-lb. Gasoline	One-Horse Wagon (½ Extra Horse)
Total annual expense	$2,455.00	$2,810.00	$1,854.00
Cost per day	8.60	10.40	6.50
Cost per mile	0.23	0.27	0.23
Cost per delivery	0.067	0.075	0.085

ESTIMATE FOR CITY PARCEL DELIVERY

	1,000-lb. Electric	1,000-lb. Gasoline	One-Horse Wagon (½ Extra Horse)
Total annual expense	$2,365.00	$2,735.00	$1,812.00
Cost per day	8.30	10.10	6.40
Cost per mile	0.25	0.30	0.27
Cost per delivery	0.042	0.05	0.045

ESTIMATE FOR FURNITURE DELIVERY

	4,000-lb. Electric	4,000-lb. Gasoline	Two-Horse Wagon (1 Extra Horse)
Total annual expense	$2,749.00	$3,366.00	$2,457.00
Cost per day	9.75	12.50	8.60
Cost per mile	0.31	0.38	0.35
Cost per call	0.31	0.38	0.35

ESTIMATE FOR BEER DELIVERY, 3.5-TON RATING

	7,000-lb. Electric	7,000-lb. Gasoline	Two-Horse Wagon (2 Extra Horses)
Total annual expense	$3,252.00	$3,845.00	$2,866.00
Cost per day	11.40	14.25	10.00
Cost per mile	0.37	0.43	0.46
Cost per call	0.52	0.62	0.66

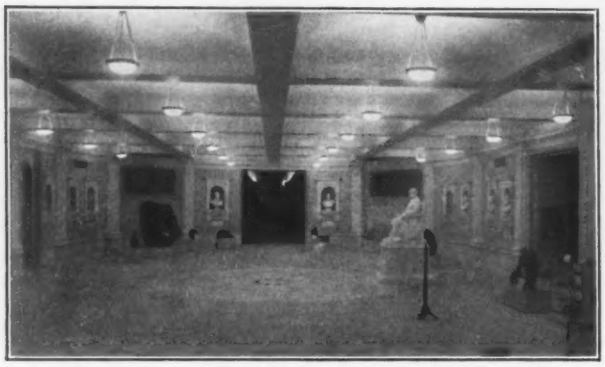
ESTIMATE FOR COAL DELIVERY, 5-TON RATING

	10,000-lb. Electric	10,000-lb. Gasoline	Three-Horse Wagon (2 Extra Horses)
Total annual expense	$3,610.00	$4,380.00	$3,135.00
Cost per day	12.30	16.20	11.00
Cost per mile	0.45	0.51	0.59
Cost per ton, delivered	0.54	0.61	0.71

Illumination and Wiring

Lighting of Foyer of Museum of Natural History

In a large museum one naturally expects the lighting to be in keeping with the dignity of the place and to harmonize in effect and appearance with architecture and interior decorations. The foyer of the Museum of Natural History, New York City, presents an excellent example of a lighting installation which conforms with the general requirements of dignity and harmony and at the same time employs a fixture which is simple, attractive and effective.



SEMI-INDIRECT LIGHTING IN MUSEUM OF NATURAL HISTORY

The hall is 110 ft. long by 60 ft. wide with a height of 17 ft. The ceiling, which is divided into twenty-four bays, is tinted a soft cream color, while the walls are of buff color. The side columns and tablatures are of white marble, as are also the busts in the niches, the latter being of the same color as the walls. At the center of each bay is suspended a fixture containing three 100-watt tungsten lamps arranged horizontally within the frosted-glass bowl. The lamps are so arranged that the filaments are close together at the center, thereby eliminating bright spots on the glass bowl and also practically preventing any shadow from the chains being cast on the ceiling. The illumination obtained is approximately 4 ft.-candles at the floor. It is remarkably uniform and without noticeable glare.

The fixtures were manufactured by the Falkenbach Manufacturing Company, Inc., New York, and the installation was made by Chief Engineer Langham of the museum.

Two-Motor Flasher Control of a Large Sign

The novel sign illustrated herewith is installed at Indianapolis, Ind., and presents the spectacle of a locomotive starting from standstill. At first the wheels revolve slowly and great puffs of smoke appear from the stack, but as the train gets under headway the wheels and side-rods accelerate and the smoke is emitted more and more rapidly until finally full speed is reached.

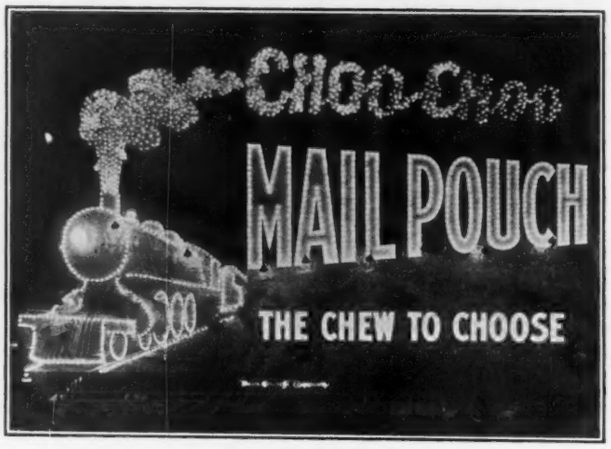


FIG. 1—REALISTIC FLASHING SIGN IN INDIANAPOLIS

Two thousand 10-watt lamps are used in this display, which measures 57 ft. long and 35 ft. high. The locomotive itself measures 18 ft., and the letter "M" in the word "Mail" is 15 ft. high. As the smoke drifts back, it forms in succession the letters of the punning word "Choo-choo," which contributes to the popular interest in the clever arrangement. Finally the words "Mail Pouch" appear, followed by the phrase at the bottom, "The chew to choose."

More than 12 tons of structural steel were used in erecting the framework, roof trusses, etc. Nine reflectors illuminate the painted portions of the display, which includes an excellent representation of the locomotive. The Thomas Cusack Company of Indianapolis erected the sign, which was designed by Mr. F. E. Faver.

Control of the display and acceleration of the smoke and moving-part effects is accomplished by means of the Betts & Betts flasher shown in Fig. 2. The small motor at

FIG. 2—SOLENOID SWITCH AND MOTOR-DRIVEN FLASHER

the extreme left runs continuously, driving the main flasher parts. Geared to the flasher-shaft movement, however, is the rheostat arm controlling the speed of the second motor which operates the contactors for the smoke and side-rod lamps. At the proper instant in the sign's cycle the second motor is thus started up, driving its separate contact cams and, as it accelerates, producing the effect of the locomotive getting under speed. The first motor thus runs continuously, but the second is started and stopped during each cycle of the sign's operation.

At the left is seen the solenoid switch which breaks the main circuit just before the various cam contactors are ready to open, thus insuring that all the sign circuits will be extinguished simultaneously. This switch automatically closes again a second or two before the first contactor makes connection. Where there are a large number of contact arms in a flasher of this size "ragged" effects are sometimes caused by difficulty in adjusting the numerous fingers to break at the same time, but the magnet-switch device shown insures that all circuits will be extinguished at the same instant.

Electric Service in the Home

A number of practical suggestions for amplifying the convenience of electrical service in the home were offered by Mr. F. B. Adam, of the Frank Adam Electric Company, St. Louis, Mo., in a recent address before the St. Louis League of Electrical Interests, Jovian Chapter. Of the total attendance of 102 at the meeting, twenty-five were architects who responded to the general invitation issued by the league.

The electrical equipment of the average home, said Mr. Adam, amounts to only 1.5 per cent of the cost of the structures, not including the cost of the ground or the furnishings for the building. If "economy" is insisted on, the architect can even get the cost down as low as 1.25 per cent, always of course at the sacrifice of comfort and convenience to the owner and of a profitable and satisfactory customer to the electrical industry.

When the architect calls a practical electrical man into consultation concerning the requirements, the cost of the electric work goes up; and whenever the architect is liberal enough to call in the contractor to consult with the owner, and shows him the advantages of equipping his home for "everything electrical" while in course of construction, the percentage of cost is further increased by 3 and even 4 per cent—an average increase of more than 100 per cent over what, under ordinary conditions, should be considered a good job.

In advising the installation of an ample number of plug outlets, Mr. Adam referred to an instance where he recommended at least one receptacle for each room and hall on the first and second floors. The owner then found that the outlet locations did not suit the arrangement of his furniture, and an additional plug outlet was put in each room. After moving in, however, the householder declared he had only one "kick" coming on the job, and that was he regretted that a plug connection had not been installed in each of the four corners of each room and hall.

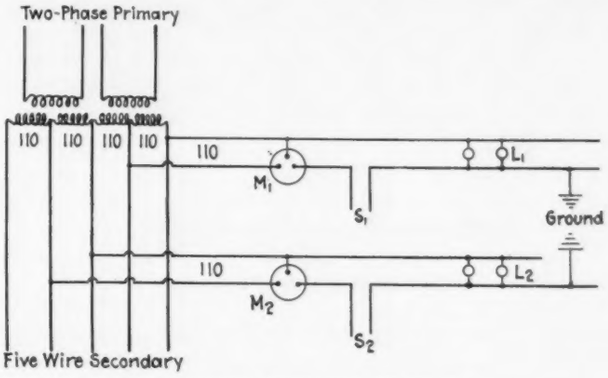
During the past two years the speaker has advocated for the average-sized home one separate circuit of No. 12 wire, or if possible No. 10 wire, to take care of heating, cooking and power connections. He has also recommended for the past five years the fusing of lighting circuits of 660-watt capacities and less, with 10-amp fuses, to take care of not only the lamps on the circuit but also the connections for curling irons, milk warmers, small stoves, percolators, toasters and the like. But since the advent of the vacuum and suction cleaner there has been much trouble from the blowing of circuits protected with 6-amp and 10-amp fuses, and it has been found necessary for nearly all makes of vacuum and suction cleaners to use 15-amp fuses. As such a current is too large for the small wiring of the ordinary lighting fixtures, the speaker argues in favor of the separate circuit of No. 12 or No. 10 wire.

"We have never in our advocacy of this method had an owner refuse the expense of a separate No. 12 or No. 10 circuit," said Mr. Adam, "after he has been told of the benefits of such a circuit. Of course, it must also be understood that the larger the house the larger the number of these circuits that should be installed."

Lamp Operation Due to Accidental Grounds

Among the troubles recently reported to an Eastern central-station company was the complaint of one customer that he could not turn out part of his lamps. When his snap switch was turned "off" the lamp candle-power was simply reduced, the filament continuing to glow dimly. While this case was being investigated another customer came in with a similar complaint concerning his own installation, which was about 150 ft. distant from the first.

Inspection showed that although both customers' snap switches might be open, the lamps would burn at low voltage. Furthermore, it was found that this energy consumption was not being recorded on either meter. With one switch closed, its own lamps would burn at normal voltage and candle-power; meanwhile the second set of lamps received about 50 volts and could not be turned off by means of their own switch.



GROUNDED LIGHTING CIRCUITS

After a search the accidental ground of the first installation was located in a fixture which had been hung without an insulating joint. In the second case the ground was caused by abraded insulation where a wire passed through an iron post. As shown by the sketch these two grounds completed the circuit between the pair of 220-volt mains, so that while both single-pole switches were open the pairs of lamps were burning in series-multiple through the ground resistance. It so happened, too, that the grounded side in each case passed through the series coils of the meter, so that no registration was made of the current continuously in the fugitive circuit.

Recent Telephone Patents

Improved Automatic System

Automatic telephone systems of many different styles have been designed in which the selective apparatus is operated in response to a series of impulses corresponding in some way to the desired telephone number. In the system patented by Mr. E. Blos, of Schoneberg, Germany, the required differentiation is obtained by using two impulses for each selection and by using the two line limbs in different combination. There are three of these combinations.

Each may be used for the first impulse, associated with itself or another for the second. There are thus nine combinations, and to meet this condition all numbers containing ciphers have been abandoned.

The mechanical features of the selection may be likened to those of a Yale lock. Four notched disks are arranged upon a common axis. Each receives a slight angular displacement by an impulse received over the controlling line limb. One pair of disks acts upon the first impulse and the second pair upon the second impulse. There are as many sets of notches as there are units in a digit, and in front of each set is arranged a bar which controls the contacts for that unit. When a set of impulses arrives one set of notches of the shifting disks will be so aligned that a bar may fall in and establish the proper contact.

Switchboard Circuit Systems

The common-battery switchboard circuit seems capable of an almost unlimited number of rearrangements and combinations. One of these, recently patented by Mr. W. W. Dean and assigned to the Dean Electric Company, is of the two-wire type very much like the Dunbar system. A cut-off relay with a double winding is used. One winding is of low resistance and the other of high resistance. When the cut-off relay is not energized the former winding is connected between the jack sleeve and ground and the high-resistance winding is short-circuited. When a plug is inserted the current during the first instant is heavy and a very positive action of the cut-off relay results. This action transfers the short-circuit from the high-resistance winding to the other winding and the usual high impedance conditions are thereby established.

Letter to the Editors

Heterochromatic Photometry

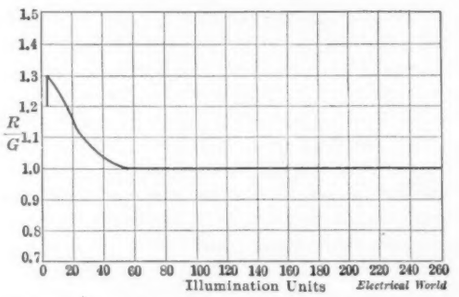
To the Editors of the Electrical World:

Sirs:—My own work on heterochromatic photometry having been referred to several times in your editorial comment on the article by Mr. M. Luckiesh in your issue dated March 22, I feel warranted in calling attention to certain statements that produce an incorrect impression concerning ideas and conclusions attributed to me.

Mr. Luckiesh's work shows a reversed Purkinje effect with the flicker photometer for the special case of a red light against a green light. This effect was discovered, studied and described at considerable length by me some time since.* From your editorial it is to be gathered that Mr. Luckiesh has found an effect far greater than my work indicated, and that "there is much to be investigated here." For the magnitude of the effect found by me and also for its partial explanation, let me refer you to my "Studies in the Photometry of Lights of Different Colors," *Philosophical Magazine*, July, September, November and December, 1912. In the tables of the first paper of that series will be found data which when plotted give the kind of curve shown by Mr. Luckiesh. As a matter of fact, a plot of these data was made in this form for that paper, but was later omitted as unnecessary in view of the more significant manner in which the phenomenon is shown in the luminosity curves, because of the full description and the complete numerical data. However, in the second paper, on page 361, the course of this reversed Purkinje effect and its magnitude are arranged in a logarithmic plot, which shows also the reversal of this effect at very low intensities and the result of decreasing the size of the photometric field. For the benefit of those who have not the leisure to plot these data or to transform the logarithmic plot (which, for reasons given in the original paper, is the more logical one) to ordinary units, there is reproduced herewith, from the figure referred to, the relative readings for red and green light (0.653 μ and 0.535 μ) at various illuminations, plotted, however, in ordinary instead of logarithmic units. This curve is, I think, sufficient to show the impression that Mr. Luckiesh's results are new and disconcerting to be an erroneous one.

It would have been better for the popularization of my work had it been presented in even greater detail, with more extended comment and with the data plotted in several more relationships and on more kinds of scales than they are. One expects, however, that those who engage in a line of research or undertake to write authoritatively thereon will acquaint themselves rather thoroughly with previous work. Is it too much to expect them to plot the old and the supposedly new data on the same scale before making comparisons and drawing conclusions?

The statement by Mr. Luckiesh that the flicker and equality-of-brightness photometers "do not measure the same thing" is, I think, fully covered by the third of my series of papers, in which the opposite conclusion is reached. It is there shown that with the equality-of-brightness method different values may be found for the relative brightness of two colors, depending on the color of the comparison light, and also because of the variation of one's criterion from time to time. But it was also shown under what conditions the two methods give similar results and why the flicker value may be identified with the true mean value around which the equality-of-brightness measurements vary. For the full discussion of this point the original paper should be consulted. I see no reason to alter the conclusion there drawn.



REVERSED PURKINJE EFFECT WITH FLICKER PHOTOMETER

There are, of course, in any problem many points demanding further investigation, and heterochromatic photometry is no exception. But I do not think such points are the ones upon which emphasis was laid in the editorial. I fail to see in this paper by Mr. Luckiesh anything but a confirmation of various points described and more completely investigated by me. I except, however, his assertion that the inverse square law does not hold for red light, being unable to understand just what this means.

Philadelphia, Pa. Herbert E. Ives.

[We very much regret that Dr. Ives should in any way feel that his valuable work is unappreciated by us. Such is far from the case, the chief cause for our comment being the considerable troublesome variations brought to our attention after believing Dr. Ives' work had put the flicker photometer in an unquestioned position. We are quite willing to accept Dr. Ives' statement as to priority, but, in view of the facts graphically set forth in Mr. Luckiesh's paper and by reason of the extraordinary results reached by M. Broca and his colleagues, it is pertinent to say that the question of heterochromatic photometry is reopened until these discrepancies are investigated and explained by someone. We know of no one more competent than Dr. Ives to do this, and hope that he will undertake the work. —Eds.]

*Trans. I. E. S., November, 1910.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Protecting Exposed Metal Work in Battery Rooms

It is very essential that no metal work in the battery room, especially over the cells, be exposed to the action of the acid fumes and gases. The structural ironwork of the building can be very well protected by incasing it with expanded metal work upon which a coating of cement plaster is placed. This, if kept well painted with a good lead paint, will prove a very satisfactory way of protecting all structural metal work. Pipes and small portions of metal work can be protected by sheet lead, or if they are not in too close proximity to the cells can be protected sufficiently by frequently cleaning and painting with acid-resisting paint. This paint is very thick and heavy and forms a strong, heavy protective coating. It does not contain coal tar to corrode the metal. Paint of this kind is claimed to be acid-proof, gas-proof and sulphur-fume-proof. The battery rooms in all new electric substations of the New York Central Railroad are painted with preservative paint of this character.

One great danger of exposed ironwork in a battery room, if it extends over the battery, is that the sulphate of iron formed by the action of the fumes may fall into the cells and impair the purity of the electrolyte, thereby seriously damaging the plates.

Testing Lamps by a Motor-Driven Machine

The accompanying photograph illustrates a home-made lamp-testing machine in use in the installation department of the Edison Electric Illuminating Company of Boston, Mass. Special advantages of the device are the increased speed with which lamps can be tested, as compared with former hand methods, and the use of an automatic counter which insures accurate enumeration of all lamps passed through the apparatus.

The device consists of an endless belt carrying about two dozen sockets spaced at 6-in. distances, three driving pulleys

LAMP-TESTING MACHINE OF BOSTON EDISON COMPANY

and a small 110-volt motor. Two brass contact strips ¾ in. wide are provided for a distance of about 2 ft. below the upper belt at the left-hand end of the machine. Lamps returned from customers' installations are placed in the sockets, and as the machine operates they pass rapidly from right to left, each base actuating the counter and being made alive as the upper portion of the belt passes over the brass contact strips. The belt is 3 in. in width and runs over the contact strips just long enough to enable an operator at the left of the machine to see whether each lamp burns properly or not.

Lamps which burn properly on this test are culled from the rest and, after being photometered into two grades, are installed in various company buildings, in portions of its power plants and substations, or sent to contractors for the rough usage of field work. The usual capacity of the machine is about 3000 lamps per day, with one man working at each end; but it will feed seventy lamps per minute, and in one stretch of four hours a record of 9000 lamps was obtained.

Experience with Oil Engines in Minnesota

Mr. E. A. Aspnes, of Montevideo, Minn., read a short paper at the recent St. Paul convention of the Minnesota Electrical Association giving a report of a test on a 170-hp Diesel engine. The engine under test is a three-cylinder vertical machine, operating on the four-stroke Diesel principle and turning at 200 r.p.m., with a guaranteed overload range of 25 per cent. It was installed in October, 1911, for the city of Granite Falls, Minn., as a reserve to the municipal water-power plant.

Fuel oil is supplied by gravity through a 1-in. pipe from an outside tank to a 25-gal. tank in the engine room. From this tank a 0.75-in. pipe conducts the oil through a strainer to the engine. The gage glass on the supply tank was carefully marked to read in gallons.

Compressed air needed in the operation of the engine is furnished by a three-stage compressor, belt-driven from a pulley on the shaft of the oil engine. Cooling water for the engine and compressor is taken from the city mains and discharged to the sewer. The engine drives through a belt a three-phase, 60-cycle, 2300-volt, 150-kva generator made by the Electric Machinery Company and running at 900 r.p.m.

Arrangement for the Test.

In addition to the regular switchboard instruments for the test three ammeters, one voltmeter and a calibrated three-phase wattmeter were connected in the leads between the generator and the switchboard instruments. A test load was obtained by connecting three No. 8 wires to three 1-in. pipes, each about 3 ft. long, suspended as electrodes in the tailrace of the water-power plant. These electrodes were arranged in a triangle so as to balance the load on the three phases.

During the fall and winter of 1911 and 1912 the engine was operated about 1800 hours. Last fall it was inspected and readjusted by an expert from the factory. No adjustments have been made since that time by the operating engineer except in taking up wear in the crank and journal bearings. During the winter of 1912-1913 the engine has been run about 400 hours. As it is in daily operation, little time was available for making the test.

Fuel Oil Consumption per Kilowatt-Hour

Two readings were taken during the evening of March 1, while the engine was in actual service. During this run 9.1 kw-hr. and 8.25 kw-hr. were generated per gallon of

fuel oil. Three runs of rather short duration were made on March 2. The kilowatt-hours per gallon of oil in these tests were 9.5, 9.25 and 7. In the case of the 9.5 result, which was the highest efficiency obtained, the load was approximately 71 kw. The figures of all five tests are given in the accompanying table. The author of the paper remarks that the exhaust was very dark, filling the engine room with smoke in a short time. His conclusion is that, as the generator is of good design and the belt in good condition, the tests do not show that the engine maintained its rated output and efficiency.

Mr. Aspnes described the lubrication of the engine, which is done by the splash system. The amount of oil used in daily operation for lubrication is 1 pint per hour, mixed with about 3 gal. of water. No difficulty seems to be encountered in starting the engine with compressed air. Quite often, however, it happens that the pressure in the cylinders exceeds the predetermined pressure before the engine reaches full speed, causing the relief valves, which are set

SUMMARY OF TESTS OF A THREE-CYLINDER 14-IN. BY 21-IN. DIESEL ENGINE

	NUMBER OF TEST				
	1	2	3	4	5
Load in kw at switchboard.	....	....	71.22	85.385	105
Speed, r.p.m.	198	200	202	196	190
Injection air pressure, in atmospheres	60	60	73	73	75
Gallons oil per kw-hr.	0.11	0.12?	0.152	0.1081	0.143
Kw-hr. per gallon oil.	9.1	8.25	9.5	9.25	7

at 800 lb., to discharge. This makes a good deal of noise. The summary of the tests, as given by Mr. Aspnes, is shown by the accompanying table.

Ten Gallons Oil per 100 kw-hr. at Thief River Falls

Mr. Leonard Peterson, superintendent of the municipal electric-light plant at Thief River Falls, Minn., opened the discussion. He said that his city installed two 225-hp Diesel crude-oil engines about a year ago. These engines are directly connected to 150-kw Sprague direct-current generators running at 164 r.p.m. The plant was installed as an auxiliary to water-power, but on account of the low water in Red Lake River it has been in almost constant use since November of last year.

In actual operation Mr. Peterson finds that the engines are using considerably less fuel oil than the guarantee of the maker, the Busch-Sulzer Brothers-Diesel Engine Company, which is also the maker of the engine referred to in Mr. Aspnes' report. At no time has more than 10 gal. of oil per 100 kw-hr. been required at the Thief River Falls plant, whereas the guarantee of the builders was 12.5 gal. per 100 kw-hr. at from one-half to full load. The oil costs 7.6 cents per gallon laid down in the storage tank. Figuring an average consumption of oil of 10 gal. per 100 kw-hr., the cost of fuel oil per kilowatt-hour at the switchboard is 0.76 cents. Adding the cost of lubricating oil, water and engine-room labor makes a total operating cost of about 0.8 cent per kilowatt-hour at the switchboard.

Desirable Operating Characteristics

As a standby for water-power plant Mr. Peterson said that the Diesel engine is superior to any other prime mover of which he has knowledge. There is no expense when the engines are shut down, and they can be started up in five minutes. The regulation is good; at different times full-load and overload conditions have been thrown on from no-load, with a change in voltage of only 5 volts in 220 volts. The engines have operated over a year without any interruption of service, although the men in charge of them had never seen a Diesel oil engine before the installation was made.

The cost of repairs for the two units during the year has not exceeded $10. In relation to Mr. Aspnes' complaint that during one test the engine did not come up to speed and emitted black smoke from the exhaust, Mr. Peterson said that this would indicate that the valves were in poor condition or else that the exhaust-valve springs were broken. There has been no trouble from this source at the Thief River Falls plant. It is very important to have all valves tight and the fuel-needle valve set properly to insure that there shall be economical operation and that the engine shall run properly.

Cost of Oil-Engine Installation and Use

Mr. Ludwig Kemper, of Albert Lea, does not favor the Diesel engine. With fuel oil at 3 cents a gallon his experience has been that the cost of repairs and maintenance amount to as much as the cost of the fuel. The first cost is also a serious item. He has figured that in his own city an oil-engine plant with complete equipment would cost $130 per kw installed, whereas a modern steam-turbine plant, complete with condensers, would cost only $90 per kw. The increasing price of fuel oil is also to be taken into consideration. At present prices oil for fuel costs more per kilowatt-hour than does coal at $3 per ton, if the steam plant used in the comparison is a modern turbine installation.

Mr. Holmes Ives, of Redwood Falls, as a result of his experience, spoke favorably of the Diesel engine.

Mr. H. B. Rutledge, of Glencoe and Howard Lake, expressed his belief that the Diesel engine will take its place as an auxiliary in water-power stations and small non-condensing steam plants. He doubts if it can compete with steam turbines in units of 300 kw or more. The oil engine is going through a stage of development, just as the steam turbine did, and no doubt for its own particular field it will be brought to a satisfactory state of excellence.

Grounding Secondaries to Water Pipes

Our local water company has raised objections to our making any ground connections to its pipes or mains, declaring that such connections may cause electrolysis and damage the pipes. Is it not true that in several large cities secondary systems are now in operation grounded to the water pipes with the entire sanction and approval of the water company? P. K. F.

Although some water companies have objected to water-main grounds, this difficulty has not proved important except in localities where the extreme dryness of the soil makes other means of grounding either too expensive for use or to fail of their purpose altogether. Oddly enough, however, the objection to grounding has been persisted in by certain individual water-works managements, in the face of the action of the largest water companies and the recommendations of the best hydraulic engineers. The flow of alternating current in appreciable amount over such grounds is an abnormal condition and one soon detected. If the grounds are adequate, such condition will be soon relieved by the blowing of the next fuses back of the trouble. But even with considerable alternating-current flow no electrolytic injury is to be expected according to the best authorities. And with grounding to the water pipe the tendency of alternating current to leave the pipe except at another ground would be almost wholly lacking, as a better path would be impossible. When it is considered that the flow of an appreciable alternating current is abnormal, that such current does not cause electrolytic damage, and that for the current to leave the pipe for damp ground would be an extremely rare happening, the remoteness of possible damage is quite evident.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Mercury-Vapor Rectifier.—HARTMANN-KEMPF.—A paper read before the Berlin Electrical Society on mercury-vapor rectifiers of high capacity, according to the system of Schaefer, using steel containers (see *Digest,* Nov. 30, 1912, page 1157). A 100-kw rectifier is shown in Fig. 1. In a foundry in Frankfort one of these rectifiers is in successful operation, transforming 45-cycle single-phase current into direct current at 220 volts for driving a number of shunt and series motors with a considerably fluctuating load. A 20-kw rectifier of the same type is used in Strasburg for charging storage batteries. Both have proved very satisfactory in practice. A third installation of 300-kw, consisting of four 75-kw rectifiers, is soon to be installed in Mannheim. An account of the extended discussion which followed the paper is also given. The difficulty of removing quickly the last traces of gas from the containers is pointed out and acknowledged; artificial heat must be applied for this purpose. The efficiency averages about 80 per cent, and under favorable conditions it may be 88 or 90 per cent. The expense of the experimental rectifiers in the past has been very high, the cost per kw being about $250, but it is expected that when the rectifiers are built commercially on a large scale the cost will be brought down to that of the rotary converter or less. On account of the simplicity of construction the cost of the rectifier itself will be much lower, but the necessity of using transformers and rectifiers will increase the total somewhat. Reference was made to the extended use of mercury-vapor rectifiers in the United States in series arc-lamp systems and in telephone exchanges. According to an investigation of Tschudy, the variation of the efficiency with the frequency is small.—*Elek. Zeit.,* Feb. 27, 1913.

FIG. 1 — 100-KW MERCURY-VAPOR RECTIFIER

Mercury-Vapor Rectifier.—E. DE LONGUEVAL.—The author reviews recent progress of the mercury-vapor rectifier. He first gives an abstract of a paper presented by Maurice Leblanc, Jr., before the International Society of Electricians in Paris, reviewing, first, the construction and electrical connections of single-phase and polyphase rectifiers, giving a brief mathematical theory of their operation and sketching their various applications in practice. The author then refers to recent attempts to construct mercury-vapor rectifiers of large capacity. For the solution of this problem it is necessary to replace the glass globe by a metallic receptacle.—*La Lumière Elec.,* March 1, 1913.

Transformers.—J. REYVAL.—The conclusion of his illustrated article on the construction of transformers. In the present instalment the author discusses three-phase transformers and outlines the various methods that are used in making connections of transformers.—*La Lumière Elec.,* Feb. 8, 1913.

Lamps and Lighting

Periodic Fluctuation of the Candle-Power of Alternating-Current Metallic-Filament Lamps.—ABSALOM LARSON.—An account of an experimental investigation of the fluctuations of the candle-power of alternating-current metallic-filament lamps during one period. A stroboscopic method was used. A round disk with four slits was placed between the lamp and the photometer and rotated by a four-pole synchronous motor. The photometer thus received light only four times during each revolution through the slits; that is, twice for each period of the alternating current. The voltage curve of the generator was approximately sinusoidal, the frequency 50 cycles per second. It was possible to adjust the position of the disk relatively to the axle of the motor in a series of regular angular intervals. When one experiment had been made the small synchronous motor was stopped, the position of the disk was changed by a certain angle, the motor was started again and a new measurement was made. In this way it was possible to determine the candle-power of the lamp at different instants during one period. Of course, during one period of the alternating current there are two periods of light fluctuation. The results are given in Fig. 2 for five different lamps. The abscissas represent time, the period of the light fluctuation being 0.01 second. The ordinates give the relative amount of the candle-power at the different instants. Curve I refers to an osram lamp of 220 volts and 10 cp, curve II to an osram lamp of 220 volts and 16 cp, curve III to an osram lamp of 220 volts and

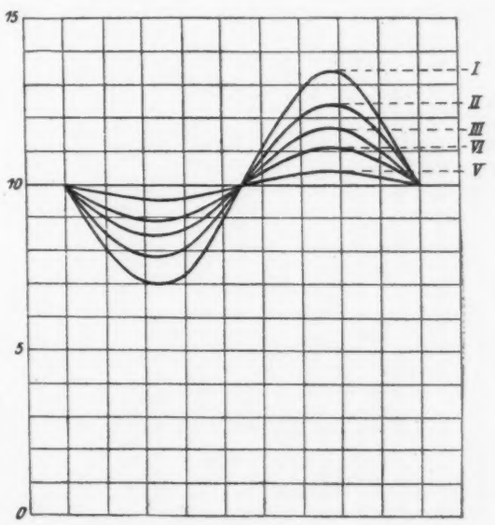


FIG. 2—FLUCTUATION OF CANDLE-POWER DURING ONE-HALF PERIOD

25 cp, curve VI to an osram lamp of 220 volts and 50 cp, and curve V to a "reductor lamp" of 14 volts and 16 cp. The candle-power fluctuation is greatest for the 10-cp lamp, the candle-power fluctuating between 7 cp and 13.4 cp, so that the variation each way from the mean value is about 30 per cent. The diameter of the wire of the 10-cp lamp is 0.01 mm. With increasing thickness of the wire the relative fluctuation of the light decreases. For the

"reductor lamp" with a filament diameter of 0.08 mm the variation of the candle-power from the mean amounts to 1.4 per cent. For comparison a test was made with a 220-volt, 10-cp carbon-filament lamp. Its curve is practically identical with curve VI. The candle-power curves are not sinusoidal. On account of their light fluctuation 220-volt, 10-cp osram lamps can conveniently be used for determining the slip of an induction motor by a stroboscopic method. For the same effective voltage the candle-power with alternating current differs from that with direct current. If the candle-power with direct current is taken as unity, the results shown in the accompanying table are obtained with a 10-cp, 220-volt osram lamp. For the same voltage the

CANDLE-POWER OF ALTERNATING-CURRENT LAMP AS COMPARED WITH DIRECT CURRENT

Periods	Volts	Candle-Power
50	220	1.016
50	250	1.020
50	268	1.022
30	220	1.037

measured candle-power is, therefore, greater with alternating current and the difference between alternating current and direct current candle-power increases with increasing voltage and especially with decreasing frequency. This is to be taken into consideration in photometric tests.—*Elek. Zeit.*, Feb. 27, 1913.

Generation, Transmission and Distribution

Steam Turbines.—H. D. Herr.—A very long and profusely illustrated paper on recent developments in steam turbines. The paper gives the early history of the steam turbine and its elementary principles and then describes the more recent developments of the De Laval turbine, the Curtis turbine, the Rateau turbine, the Parsons turbine and the Westinghouse turbine. Then follows a comparison of steam turbines concerning their reliability, maximum output and economy. Notes are added on non-condensing turbines, low-pressure turbines, bleeder turbines and mixed-pressure turbines. After some remarks on the application of the turbine in the field of centrifugal pumps and for auxiliary apparatus in power stations, the author takes up in greater detail the application to marine service and describes the Westinghouse-Melville-Macalpine reduction gear.—*Journal Franklin Inst.*, February and March, 1913.

Dangerous Rises of Voltage.—W. Petersen.—The conclusion of his long and highly mathematical paper on dangerous rises of voltage and methods of protection of the network against the same. In the concluding instalment some details of protection are discussed and some rules are given for calculating the phenomena of traveling waves.—*Elek. Zeit.*, March 6, 1913.

Installations, Systems and Appliances

Switches.—The proposed rules of the German Association of Electrical Engineers for the construction and methods of testing of switches and automatic circuit-breakers for pressures up to 750 volts.—*Elek. Zeit.*, March 6, 1913.

Wires, Wiring and Conduits

Notation of Polarity of Conductors.—A committee of the German Association of Electrical Engineers has worked out proposed rules for the notation of the polarity of conductors on switchboards. For direct current they are as follows: The positive pole should be painted red, the negative pole painted blue, and earth connections and the earthed neutral conductors painted black with white rings. Earthed conductors of other polarity should have the color of their polarity together with black rings. Unearthed neutral conductors should be painted black with red rings. For three-phase currents the proposals are as follows: The three conductors should be painted yellow, green and violet and designated with the letters R. S. T. where the series of the colors and of the letters R. S. T. indicate the series in succession of the phases in time. The fourth wire is painted black with white rings if it is earthed and is painted black with red rings if it is unearthed. For single-phase current the proposals are as follows: The two conductors are painted yellow and violet. If there is a neutral conductor it is painted black with white rings if it is earthed and painted black with red rings if it is unearthed. If a single-phase line is part of a three-phase system, the colors as used with the three-phase system are retained. On every switchboard an explanation of the colors and signs must be found.—*Elek. Zeit.*, March 13, 1913.

Iron Pipe Used for Electric Conduit.—Oliver W. Storey.—An article describing the methods of manufacture of black enamel or "black pipe" and "galvanized" or "white pipe" and discussing critically the advantages and disadvantages of the different processes and the case of "black pipe" versus "white pipe."—*Metall. and Chem. Eng'ing*, April, 1913.

Electrophysics and Magnetism

Fluorescent Roentgen Radiation.—J. C. Chapman.—A paper dealing with Professor Bragg's theory that the fluorescent X-radiation is produced indirectly by the action of the expelled beta rays, and not by the direction of the primary beam. His criticisms of a previous paper of the present author, in which an experiment was described to test this theory, are discussed. Another experiment has been performed, in which the theoretical objections he raised have been obviated. The results obtained agree precisely with those given previously and indicate that Bragg's bombardment theory does not represent even to a small extent the process of production of the fluorescent Roentgen radiation.—*Phil. Mag.*, March, 1913.

Photo-Electricity.—H. Stanley Allen.—An abstract of a paper presented before the Royal Society in London on the photo-electric behavior of iron in the active and passive state. The statement that chemical activity and photo-electric activity vary together appears to be justified. If this view be correct, it will be seen that there are degrees of activity and also of passivity.—London *Electrician*, Feb. 28, 1913.

Composition of Electromotive Forces of Induction.—A. Guillet.—A paper in which the author shows how the polygon rule of vibrations of Fresnel can be applied to the composition of electromotive forces of induction.—*La Lumière Elec.*, Feb. 15, 1913.

Electrochemistry and Batteries

Metallic Chromium for Electric Resistance Furnaces.—O. Dany-Hanault.—A paper on the use of granular metallic chromium as a resistor for an electric resistance furnace. Chromium can be heated up to temperatures near 2000 deg. But the absence of malleability and ductility has restricted its applications. It must, therefore, be used in granular form.—*Comptes Rendus*, Jan. 6, 1913; abstracted in *La Lumière Elec.*, Feb. 8, 1913.

Electric Resistor.—K. Perlewitz.—An illustrated article on the properties and uses of "silit," which is a new electric resistance material made by a process of Egly. Metallic silicon is added to silicon carbide and the carefully prepared mixture is brought into the desired form and subjected to heat in an electric furnace, whereby it bakes together into a homogeneous body. This material is especially suitable for electric heating resistors.—*Elek. Zeit.*, March 6, 1913.

Electrolytic Production of Iron Sheets and Tubes.—W. Palmaer and J. A. Brinell.—The authors were instructed by the Swedish Association of Ironmasters to investigate the Cowper-Coles electrolytic method for producing iron sheets

and tubes. This article is a translation of the report made by them. It describes the principles of the method, the construction of the electrolytic cell and the tests made of the composition and properties of the deposited sheet iron. Some factors are finally discussed which influence the economic result of the process.—*Metall. and Chem. Eng'ing*, April, 1913.

Synthetic Ammonia.—F. Haber and R. Le Rossignol.—Their report made to the Badische company three years ago on the Haber process of producing ammonia from the elements. The essential technical features of the process are the use of a high atmospheric pressure and the circulation of the high-pressure nitrogen and hydrogen gas mixture from a furnace (where at a temperature of between 500 deg. and 700 deg. C. the ammonia is formed) to a refrigerator (where the ammonia is liquefied and withdrawn) and the return of the remaining gases together with a mixture of nitrogen and hydrogen to the furnace. An account is given of the investigations as to the best catalytic agents. These are uranium and osmium. The first large scale factory is now being erected in Germany.—*Zeit. f. Elektrochemie*, Jan. 15, 1913; translated in abstract with illustrations in *Metall. and Chem. Eng'ing*, April, 1913.

Units, Measurements and Instruments

Resistance Measurements.—In a continuation of the serial on shop testing of electrical apparatus the various methods for measuring resistances are reviewed.—*Elec. Journal*, February, 1913.

Testing Ebonite for Electrical Purposes.—C. C. Paterson, E. H. Raynfr and A. Kinnes.—An abstract of a paper from the *Journal* of the (British) Institution of Electrical Engineers. Methods of testing ebonite are discussed, and the results of tests made on known qualities of rubber, with and without various adulterants, are given. As the results of these tests a specification is suggested for tests on sheet ebonite, purporting to be made from best Para rubber without adulteration: Specific gravity, to be not more than 1.21. Yield test: A cantilever of the ebonite, 25 mm (1 in.) wide and 10 mm (⅜ in.) thick, supporting a 1-lb. weight 152 mm (6 in.) from the support, shall be placed in an oven maintained at a temperature of 70 deg. C. The ebonite shall not yield so that the point of support of the weight drops through a greater distance than 15 mm (approximately ⅝ in.) during two hours at this temperature. The distance dropped shall be measured before and after the test with the weight removed. Electric strength: The sheet ebonite shall be tested for electric strength by embedding metal spheres, 51 mm (2 in.) diameter, into opposite sides of the material, so that the thickness of ebonite between them is about 0.5 mm. An alternating emf with an approximately sine-wave distribution shall then be put across the spheres and the voltage gradually raised over a period of about one minute until breakdown occurs. The test specimens and spheres may be placed under oil during this test, in which case a specimen 100 mm (4 in.) in diameter will suffice to prevent sparking around the edges. The spherical recesses in the test specimens must be machined out with a keen cutting tool, which must be re-ground before the last cut is taken, and the spheres must be a good fit in the recesses. Before the rejection of any material takes place on the ground of insufficient electric strength at least two specimens shall have been tested for breakdown, and if either of them shows the requisite strength rejection shall not take place on the ground of this test. Under these conditions of test the ebonite shall show an elecric strength of not less than 125,000 mean effective volts per millimeter.—London *Electrician*, March 7, 1913.

Telegraphy, Telephony and Instruments

Telegraphy and Telephony.—A committee of the German Association of Electrical Engineers, jointly with the committee of the German Association of Wiring Contractors, has worked out a set of rules for the equipment of telegraph, telephone and signal installations relating to the apparatus, sources of energy and wiring.—*Elek. Zeit.*, March 6, 1913.

Telegraphy and Telephony.—Devaux and Charbonnel.—A review of recent progress in telegraphy and telephony. After some notes on automatic telephony the author deals with the interference in telephony from single-phase traction systems and then discusses various problems of submarine telephone cables. He deals especially with the problem of telephonic reflections.—*La Lumière Elec.*, Feb. 1, 8 and 15, 1913.

Telephone Cable.—An article on the new telephone line between Vienna and Dalmatia, which includes a line across the sea over a series of islands. On land an overhead bronze wire is used, for crossing the sea a submarine cable. This is a continuously loaded cable of the Krarup system. The copper conductor had a cross-section of 5.5 sq. mm. Around it are wound three layers of soft iron wire of 0.2 mm diameter, and around this a special form of gutta percha is pressed. This special gutta-percha mixture was so chosen as to reduce the leakage. The speaking tests between the two ends of the combined overhead and submarine lines are said to have given a "brilliant result." The line has later on been extended and speaking tests between Vienna and Sarajevo (at a distance of 1400 km, or 840 miles) have still given good results, although the overhead line in Bosnia consists partly of bronze wires not more than 4 mm in diameter.—*Elek. Zeit.*, March 13, 1913.

New Wireless Detectors.—The Telefunken company now uses Schloemilch electrolytic detectors in which its former two chief objections were overcome, namely, the deterioration of the platinum electrodes and the leakage of acid through crevices when the detector is inverted, as often occurs in transit. The new detector illustrated in Fig. 3 comprises three Schloemilch cells radiating from the cross-

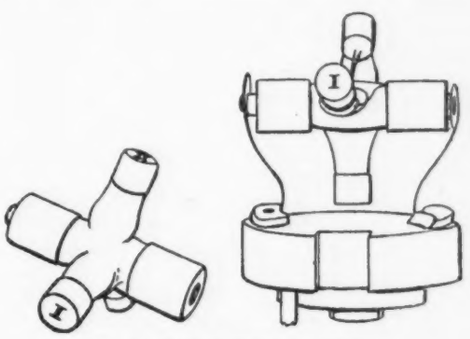


FIG. 3—ELECTROLYTIC DETECTOR

tube, as shown. The whole glass system is hermetically sealed, and connections are made to the terminal end caps by fused-in platinum wires. Sufficient acid is contained to fill one, and only one, of the cells. The latter are inclined at 120 deg. to each other, so that when one is vertical (as in use) the other two are completely drained of acid. If one cell fails or becomes insensitive, it is necessary only to rotate the system through 120 deg. to substitute another cell in circuit without appreciable interruption of working. In order that the cells may be distinguished (for experimental and maintenance record purposes) the numerals I, II and III are marked on the end caps.—London *Elec. Review*, March 14, 1913.

Miscellaneous

Theory of Commutation.—Karl Pichelmayer.—The author introduces a more general expression for a certain coefficient in the formula for calculating the commutation pressure, which he calls the commutation constant. The main factor in the commutation constant is the self and mutual inductance of the commutating coil. The commu-

tation constant must be determined for every type of machine, and its application in his formula assumes the absence of pulsating pressures.—London *Electrician*, Feb. 28, 1913.

Book Reviews

Electrical Machine Design: The Design and Specification of Direct and Alternating-Current Machinery. By Alexander Gray. New York: McGraw-Hill Book Company. 528 pages. Price, $4.

Mr. Gray's book is a work of high order. Through it runs a philosophic conception of the principles and methods used in electrical machine design. In fact, the title of the book is too narrow for its scope, as it treats most successfully of the principles of electrical engineering. A soundness of judgment and a sane and simple treatment are characteristic of the author's methods and, while the book is primarily written for students, it is really a compendium of experience enlightened by scientific method. The book deals with direct-current machinery, alternators and synchronous motors, polyphase induction motors, and transformers. From this enumeration it is not to be assumed that the treatment of each of these subjects has been exhaustive, though it has been most thorough, defining everywhere the principles and fundamental ideas rather than the empirical side. Mr. Gray's experience for many years as an electrical designer and engineer has served him in good stead and has enabled him successfully to avoid too much of the academic side so often in evidence in works of this character. The treatment is everywhere up to the latest standard of our knowledge. In the regulation of alternators the method of zero power-factor is consistently used; in the chapters on heating Mr. Gray's own investigations have been embodied; in the chapters on design very useful design sheets have been inclosed; the interpole has been treated simply and alternator windings have been discussed so far as their practical applications are concerned; the wave-form of alternating-current generators has been simply discussed; the chapter on insulation is sane and to the point; the short-circuit characteristics and the effect of saturation are discussed in a modern manner; the paralleling of alternators and the problem of resonance receive a brief consideration; the circle diagram for induction motors is derived and explained; the leakage of induction motors and the noise as well as dead points at starting are entered into. The closing part of the work deals with transformers, and this portion of the book is not quite so satisfactory as the preceding chapters. At the close the practical mechanical design is discussed and the formulas for the unbalanced magnetic pull are derived as developed by Mr. B. A. Behrend, to the training in whose engineering office Mr. Gray gracefully acknowledges his indebtedness in the preface to the book. Mr. Gray's book bears the stamp of original treatment and is one of the best contributions to electrical engineering literature of late years.

Experimental Wireless Stations. Their Theory, Design, Construction and Operation. By Philip E. Edelman. Published by the author at 2432 Lyndale Avenue South, Minneapolis, Minn. 224 pages. Price, $2.

A simple and very practical exposition of the constructive details in experimental wireless-telegraph stations, intended for the use of amateur radio-telegraphists. The fundamental principles are briefly outlined in some of the descriptions, although the book is not intended primarily for those who seek explanations of the phenomena presented in wireless telegraphy. There are nineteen chapters relating to the following subjects: Nature of wireless transmission, aerials, grounds, resonance, planning the transmitter, transformers, auxiliary apparatus, condensers, construction of helix, spark-gaps, radiation indicators, continuous waves, the receiving station, detectors, telephone receivers, tuning, receiving condensers, tuning inductances, conclusion. The book will be useful to many amateurs who seek means of constructing wireless-telegraph installations inexpensively.

Handbuch der Elektricitäts und des Magnetismus. In five parts. Edited by Prof. Dr. L. Graetz. Part II. First edition. Leipzig, Germany: Johann Ambrosius Barth. 336 pages, 252 illus. Paper. Price, 13 marks for the complete set.

A textbook on electricity and magnetism intended for advanced students of physics or of applied electricity. It is divided into three sections. The first deals with the mathematical laws of stationary currents, the second with the measurements of stationary currents, and the third with units and absolute measurements. The treatment is thorough and systematic. The chapters on the measurements of standard resistances are particularly good. The book, as one volume of the series, will recommend itself to students of electrical measurements in connection with continuous-current phenomena.

Engineering and Metallurgical Books, 1907-1911. A full title catalog, arranged under subject headings, of all British and American books on engineering, metallurgy and allied topics published during the five years 1907-1911, with their English and American prices and publishers' names. By R. A. Peddie. New York: D. Van Nostrand Company. 206 pages. Price, $1.50.

A useful book of reference in searching for the titles, authors, publishers, or principal subjects of engineering books. More than 1500 books on engineering and metallurgical topics are included in the list. It is greatly to be desired that similar publications should be made of such books in France, Germany and Italy. It is sometimes very difficult to find a book when only one of the four abovementioned particulars is forthcoming. We hope the author will see that this good work is not allowed to cease in future.

Primary Battery Ignition. A simple, practical pocket guide on the construction, operation, maintenance and testing of primary batteries for automobile, motorboat and stationary-engine ignition service. By C. Wadsworth, Jr. New York: D. Van Nostrand Company. 78 pages, illus. Price, 50 cents net.

A practical guide to the automobile driver as to the electrical connections used on the ordinary battery ignition car and as to the nature of the troubles which are likely to be experienced with the apparatus. A table of common ignition troubles and remedies appears on the last page and will be of help to an inexperienced driver. The book outlines the principles of induction-coil ignition and the methods of installing, testing and replacing batteries. It will appeal to a large number of men who operate either their own or other persons' cars.

The "Mechanical World" Electrical Pocket Book for 1913. A collection of electrical engineering notes, rules, tables and data. Manchester: Emmott & Company, Ltd. 310 pages, illus., cloth. Price, 6d.

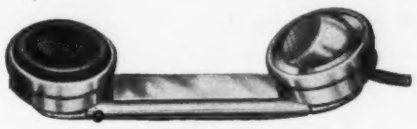
A very handy little green pocket book suited for the daily reference of mechanical or electrical engineers in regard to electrical units, measurements, apparatus, machines, connections, systems, conductors, stations and general data. Added to these are a number of tables, such as gage tables and tables of conversion factors. A memorandum diary of sixty pages is appended. The book is surprisingly good for the price at which it is offered and will be useful to many persons coming into contact with the electrical-engineering world, especially if they are interested in British practice. For the illustration of American practice the book is, of course, not directly designed.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Telephone Aid to Edison Talking Pictures

Time and time again moving-picture plays have made use of the telephone as an actor which plays a more or less important part in the working out of the dramas portrayed. In fact, the telephone has come to be such a factor in everyday life that there are very few plays of



INTER-PHONE INSTRUMENT SET

any sort which do not utilize the telephone to make the action more realistic.

The telephone has now taken another part in the moving-picture industry. It is used to help the moving pictures talk. Mr. Thomas A. Edison's latest invention, the "kinetophone," probably more popularly known as the "talking moving pictures," is a combination of film and phonograph, both of which, in great measure, have come to be known as Edison's own. In producing these talking pictures it is, of course, essential that the film reel and phonographic record should be absolutely synchronized. That is to say, when the actor's lips form a word that word must be reproduced by the phonograph at that instant, otherwise the effectiveness of the combination is entirely destroyed. This would naturally not be a very difficult matter if the reel and phonograph could be placed next to each other on the stage; but as the moving picture is invariably placed back of the audience in what is known as the "reel house," this is not possible. Furthermore, the reel house is usually entirely inclosed, with only a few openings for ventilation and others through which the pictures are projected upon the screen, and it is manifestly impossible for the operator to hear the phonograph clearly, if at all. On the other hand, the phonograph must be placed on the stage so that the sound will be directed toward the audience.

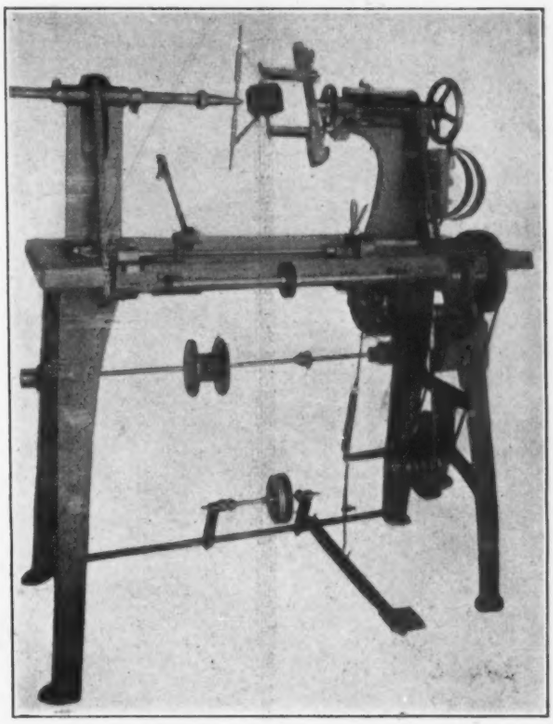
These facts have made it necessary to introduce a means of synchronizing the pictures and records. After a number of methods were tried out it was found that by making use of an intercommunicating telephone system the best results were obtained. At all moving-picture and vaudeville houses where the talking pictures are shown the two attendants—the one operating the reels and the one operating the phonograph—have telephonic communication by means of a special three-wire private-line circuit. At each end of the line a Western Electric "Inter-phone" hand set affords a means of constant and instant communication between the two men and in this way enables the operator of the picture machine to synchronize the pictures with the phonographic record. This type of hand set was chosen inasmuch as it is especially adapted for this class of service on account of being practically indestructible. In addition to the hand sets, a push button and a buzzer are installed at each station for signaling.

As a further aid to the moving-picture operators the Edison company is furnishing them with Western Electric double-head receivers, which act as an auxiliary for the hand set. This makes it possible for the machine man to attend to his work and still be in constant communication with the phonograph man and able to hear what he has to say at all times.

The kinetophone, which made its first appearance early in March, has already come to be looked upon as the logical successor to the wordless film drama. As a result of its invention, the words and actions of the leading players of the world can be handed down from generation to generation and thus provide instructive and pleasing entertainment for years to come.

Armature-Winding Machine

The mechanical armature winder illustrated herewith is manufactured by the International Fuse Lighter & Electric Company, 512 Consolidated Realty Building, Los Angeles, Cal. The device, it is explained, will wind any armature ordinarily wound by hand, from a vibrator or fan motor to a 1.5-hp machine, doing the work in a fraction of the time required by the old-fashioned method. The coil-former attachment is adjustable to any size coil or wire, from 1-hp to 50-hp size, thus eliminating the use of wooden forms. The coil taper is a very simple arrangement, which



MACHINE FOR WINDING ARMATURES

may be made ready for use in a moment. It will tape the coils accurately and to any thickness. The ring armature device can also be readily attached. For winding fields, solenoids, secondary coils, etc., of various design, the wire girder can be used with great accuracy, ease and speed. Control of the machine is effected by a friction clutch and foot lever, including all six speeds and the brake.

Electric Baking Oven

An electric oven built upon the fireless-cooker principle has recently been placed on the market by the Rochester Stamping Company, Rochester, N. Y. It is built of planished steel and is well insulated by 1-in. insulating walls. In the front door there is a panel of glass so that one can watch the process of baking or cooking without opening

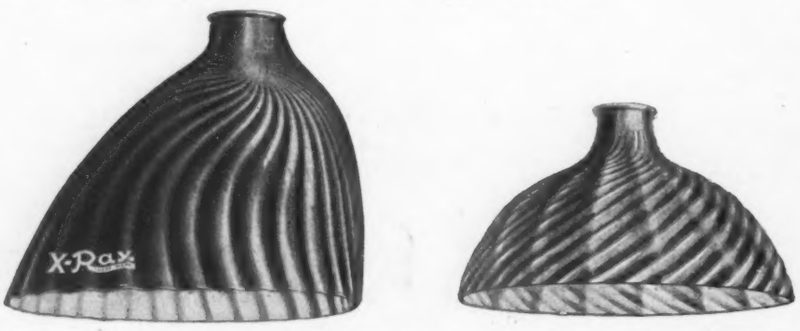
ELECTRIC BAKING OVEN WITH GLASS DOOR

the door. The heating element is guaranteed for five years. All grates and also the heating element can easily be removed so that the oven can be kept clean. It has three heating circuits for high, medium and low temperatures respectively, which are controlled by a three-circuit snap switch. It can be connected to and operated on an ordinary lighting circuit. It is said to be of proper size for doing all the baking and roasting for an average-size family.

Reflectors for Concentrated Direct Lighting

The so-called "Visor" reflector is an opaque mirror reflector designed solely for store-window lighting. It prevents light being wasted by passing over the background into the store, and it hides the lamp from the ordinary range of vision and covers it in such a way that its reflection cannot be seen in the glass or polished background of the window. It is designed for use with 60-watt or 100-watt tungsten lamps and uses a 2¼-in. holder. The dimensions are as follows: depth, front to back, 10⅝ in.; width, 9½ in.; height, 8 9/16 in.

The line of direct-lighting reflectors for use in warehouses, factories, shops, over special machinery, etc., has been augmented by the addition of a new type of reflector



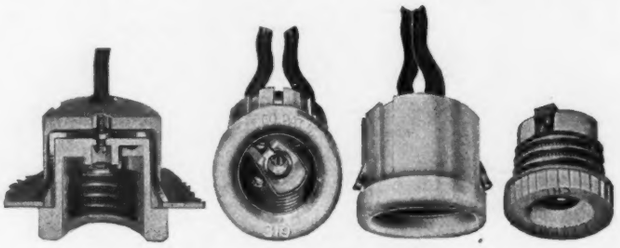
SHOW-WINDOW AND CEILING REFLECTORS FOR CONCENTRATED DIRECT LIGHTING

illustrated herewith. What is true of the show-window reflectors, as to hiding the lamps from view, is also true of the latter reflector. It is a concentrating type of reflector and is used with 60-watt and 100-watt lamps. Its dimensions are: diameter, 11½ in.; height, 6¾ in.; holder, 2¼ in.

These reflectors are made by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago.

Lamp Socket for Signs

A lamp socket which is notable on account of the easy method of installing it has been brought out by the Federal Sign System (Electric), Chicago. The socket is held by a U-shaped brass spring with projecting ends which snap out from the sides of the socket after it has been pushed in and are brought firmly up against the back of the metal



SIGN SOCKETS AND PLUG

plate of a sign by a screw in the base of the socket. The grooves in the porcelain are intended to fit the small lugs usually left projecting in holes punched for the socket and thus to prevent its turning.

Metal Holders for Outlet Boxes

A device for supporting outlet boxes has been placed on the market by the McKinley Outlet Box Holder Company, 411 Commerce Building, Kansas City, Mo.

The illustration shows the holder used with a standard outlet box having a depth of ¾ in. and using an open cover for lath and plaster work. This same holder can also be used with outlet boxes having a depth of 1⅝ in. where the open cover is not used. Similar holders are made for use with all standard outlet boxes having a depth of 1⅝ in. and using an open cover for lath-and-plaster work, and for outlet boxes having a depth of 2¼ in. without the open cover.

The device consists of two pieces, the holder and a brace. The holder is made of No. 14 gage iron, 2 in. in width and of sufficient length to permit the outlet box being installed

METAL OUTLET BOX HOLDER

at any point between the joists. The base has two slots running the entire length through which it is nailed to the bottom of a joist, thereby permitting ready adjustment, and is fastened to the body by the same bolts which hold the fixture stem.

The brace is made of strap iron 1/16 in. thick and ¾ in. wide. One end of this brace is made to fit the locking

arrangement where it attaches to the holder, and the other end is perforated in order that it may be nailed to the side of the joist.

The cost of these holders to the contractor is said to be from 25 per cent to 50 per cent less than the expense of nailing in boards.

Long-Life Flame-Arc Lamp

The new type of flame-arc lamp which is illustrated herewith contains several features of construction and operation worthy of mention. The clutch does not act directly on the electrodes in the usual way but works on the inner machined surface of the roller bearing over which the chain which connects the upper electrode holder and the lower electrode holder rod runs, thus making the clutch independent of the size of the electrode. The lamps are of the focusing design, which keeps the arc always in the same position and gives a more uniform illumination. The focusing rod, which carries the lower electrode holder, is suspended so as to eliminate all friction. Above the arc is provided a condensing chamber into which the gases rise. Coming in contact with the cold metal sides of the condenser, a powder is deposited from the fumes there. Slabs of absorbent material are placed in the condensing chamber to prevent etching of the globes by the fumes. The economizer is so designed that a maximum amount of heat is radiated and a magnetic blow ring is placed around the economizer so as to make the electrode burn squarely.

The inner globe is of clear glass with a light alabaster outer globe. The electrodes burn from 100 to 120 hours. The trimming operation is very simple. The multiple flame-arc lamp is made for use on alternating-current and direct-current circuits of nominally 110 volts, and also for circuits of 220 volts and above, these being operated in multiple series. The direct-current lamps operate at 6.5 amp, while the alternating-current lamps take 7.5 amp at the terminals but are equipped with an auto-transformer which raises the current to 10 amp at the arc. The lamps operate at the usual lighting frequencies. A 25-cycle arc lamp has also been designed. All types of this lamp are similar in external appearance and most of the parts are interchangeable.

The lamp described above is manufactured by the General Electric Company, Schenectady, N. Y.

Vertical Turbines

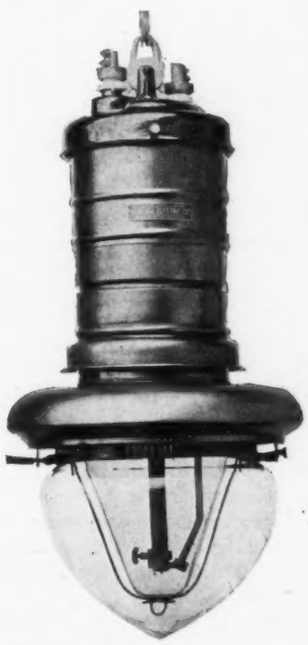
The Terry Steam Turbine Company, Hartford, Conn., has recently developed a complete line of vertical turbines rated at from 5 hp to 600 hp, operating at from 3600 r.p.m. to 500 r.p.m.

Except in the smaller sizes, where all the parts are so light that they can be comfortably lifted by one man, the casing is divided on the vertical axial plane and the cover or half casing is hinged. All the bearings are easily accessible and are supplied with forced lubrication from a single oil pump on the main shaft. The thrust is taken by a ball bearing which has been submitted to tests at six times normal load, with speeds which are 50 per cent above service speeds.

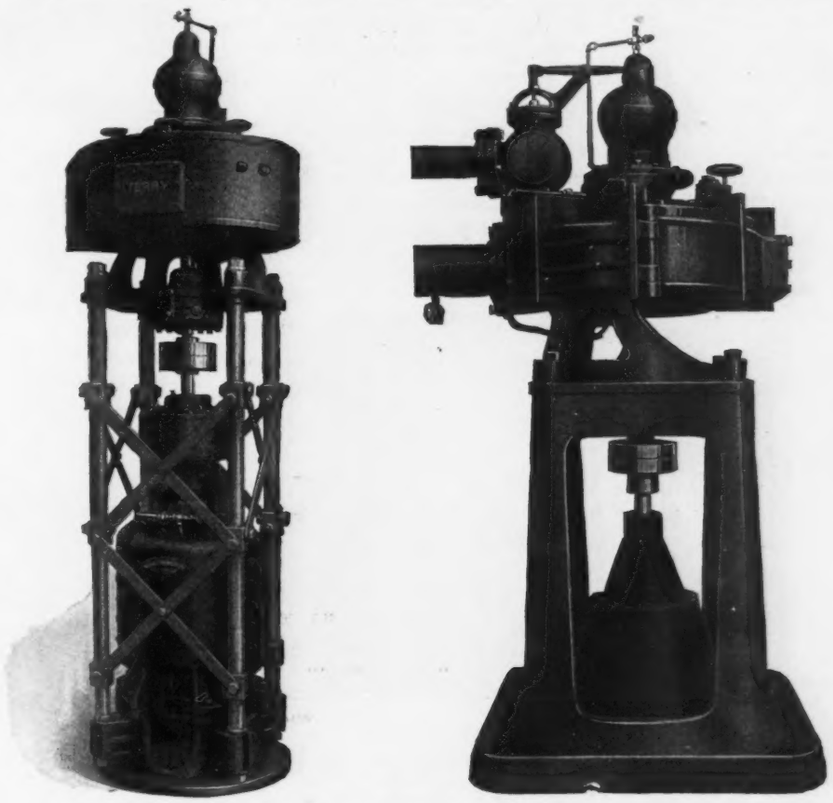
To safeguard the operation of the thrust bearing, the balls are immersed in oil when starting from rest. A constant circulation of oil through the bearing while running is provided in order to keep all the balls and races cool, clean and free from grit.

This vertical turbine has been found well adapted for deep-well pumping and on shipboard for operating forced-draft and ventilating fans.

These turbine sets are compact, of light weight, and run without vibration. They are reported to have made records of long, continuous runs without showing the slightest wear or requiring adjustment. Particular attention has been paid by the manufacturer to absolute reliability in operation without requiring attention.



FLAME-ARC LAMP

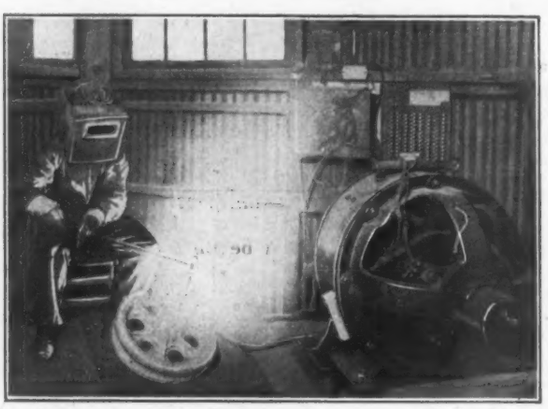


TURBINE-DRIVEN BOILER-FEED SET AND DEEP-WELL PUMPING SET

The turbine is of the single-stage type, with shaft extension to receive the fan or the centrifugal pump. All of these vertical machines can be dismantled without disturbing the steam connections.

Electric-Arc Welder

The welding machine shown herewith is a self-contained machine, thus eliminating the losses in a machine used in connection with a motor-generator set, which is said to be the only other type of arc welder on the market. There is no resistance used with it in any way, which very greatly increases the efficiency, and the manufacturers claim that in careful tests over long periods of time the actual efficiency has exceeded that of other arc welders by from 40 to 60 per cent. The intensity of the arc is controlled through connections in the series field circuits, which increase or decrease the number of turns and thereby change the amount of current in the arc. The machine can be entirely short-circuited without in any way harming it and without consuming an excessive amount of power. There are no automatic connecting devices on the switchboard. As soon as the short-circuit is put on the voltage of the arc circuit immediately drops to zero by the inherent regulation of the machine, the power taken at that time being about one-fourth of full load. This is directly opposite to the action of other arc-welding apparatus in which the current in-



SELF-CONTAINED WELDING MACHINE

creases to maximum at the time of short-circuit—that is, at the time of striking the arc—and decreases with the length of the arc.

This machine can be made for any voltage or any current and can be used for welding imperfect steel castings, cutting off risers, mis-runs, shrinkage heads, rails, I-beams or work of a similar nature. It is also useful for the welding of sheet metal, calking of boilers and work of that kind.

The fundamental principle of the machine is that the voltage of the motor between the main brushes varies as the amount of flux and position of the flux which enters the armature from the main poles. As is well known, if an auxiliary brush is put half way between the two main brushes, the voltage generated between this auxiliary brush and either of the other brushes will be equal at no-load, but as the load increases the armature reaction will so distort the field that the voltage on one side of the auxiliary brush will be very much greater than on the other side. This action is amplified by the use of an interpole with a winding which bucks the main flux. By varying the number of turns on this interpole the amount of bucking action can be controlled and therefore the amount of current in the arc can be controlled.

The machine is manufactured by the Lincoln Electric Company, Cleveland, Ohio.

Mine Locomotive

The accompanying illustrations show a type of mine locomotive which is now manufactured by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. The notable features are the open, cast-steel bar frame and the specially designed commutating-pole motors.

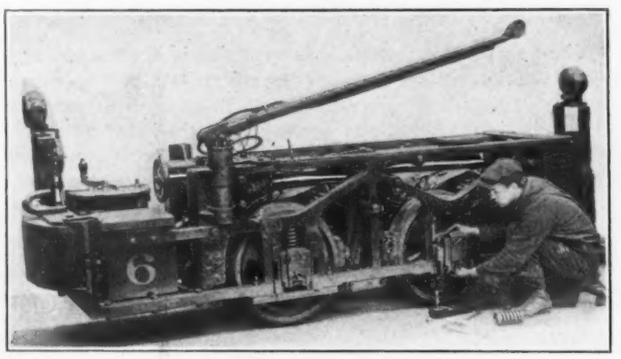


FIG. 1—ELECTRIC MINE LOCOMOTIVE

It is claimed that this locomotive will operate satisfactorily under the worst conditions with minimum attention and maintenance expense. The frame is designed to allow ready access to all parts so that the locomotive can be inspected or overhauled, when necessary, in the least possible time.

The open frame also gives better ventilation to the motors and resistors than that obtained by armor-plate frame construction. The upper parts of the motors and armature bearing housings can be removed without disturbing the suspension, so that each part of the motor is exposed for inspection. To remove the grid resistors it is necessary only to take off the locomotive covers and loosen the bolts and terminals that hold the resistor frames in place.

In mine service it is essential to provide for ease in adjustment and repair. In order to remove a journal box it is necessary merely to drop the binder and take the weight off the journal box. The journal box may then be slipped out from the side. On locomotives with inside frames the journal box cellars are arranged to be easily dropped out for re-packing. If it is desired to take out a set of wheels and axle, this may be done without disturbing the motor suspension or connections by simply blocking the motors in place and removing the binders. The wheels may then be dropped. The frames of the motors are split diagonally.

FIG. 2—DRIVING MOTOR FOR LOCOMOTIVE

The axle bearings and suspension nose are on the lower half of the frame, so that the upper half, the armature and bearing housings can be removed without disturbing the suspension or axle brackets. The armature core is mounted on a spider to which it is keyed, making it possible to remove the shaft without disturbing the windings, and also reinforcing the shaft against bending.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Efficient Emergency Work by Western Electric Company.—The first unusual demands for special service as a result of the Western tornado and last week's floods came to the Western Electric Company from Omaha, where the telegraph and telephone lines were seriously interfered with. The company was notified that 81,000 poles, 25,000 cross-arms, 100,000 pins and 32,000 ft. of telephone cables ranging in size from 25 pair to 400 pair, were immediately needed. The sudden demand found the organization prepared to make a quick response, and on the day the order was placed twenty carloads of poles, 100,000 lb. of copper wire and all of the cable went forward. The company's stock of 25,000 cross-arms at Minnesota Transfer was drawn upon. The poles went forward from the yards in Michigan and the rest of the equipment from the Chicago stock. The next call was for cable for the Chicago district, for the Western Union Company. This emergency cable, to the extent of 235,000 lb., went forward at once by express from New York, almost every through passenger train leaving the East for Chicago up to the time traffic was suspended being pressed into service to carry its quota of this cable. In the meantime the floods began to make themselves felt in Indiana and Ohio, where within a few days not only telegraph and telephone service but electric light, street railway and railroad service was completely demoralized. Again came the call for emergency line material. First of all, the company's stocks of cable, cross-arms, wire and line construction material of every description in its distributing houses at Cleveland, Pittsburgh, Indianapolis and Cincinnati were drawn upon, and then the outlying houses were notified to be ready with their assistance when it was needed. Complete stocks were available at Boston, New York, Philadelphia, Richmond, Kansas City, St. Louis, Minneapolis and Dallas—these houses constituting a chain of reserve depots surrounding the stricken district, while further west were the other distributing centers of the company which might also be called upon to help. Meanwhile, it was seen at the company's executive headquarters in New York that with depletion of all these reserve stocks they must be immediately replenished. Accordingly telegraphic orders were issued to send east from Washington 50,000 cross-arms, and requisitions were placed upon the company's sources of supply to increase the stock of copper wire available for shipment to upward of 500,000 lb., for the drawing of many hundred thousand pounds of copper wire and furnishing of from 5,000,000 ft. to 10,000,000 ft. of rubber-covered wire and outside distributing wire. Following the subsiding of the waters it was expected that there would be like demands upon the company for reserve telephone exchange equipment. At this writing the first of these calls had only just begun to come, but the company was ready with men and apparatus to meet this phase of the emergency. The first call on the New York office was on the morning of March 31, when word came to move a force of telephone installers and switchboard material with the greatest possible speed to Marietta, Ohio, where the lower floors of the Bell telephone exchange building had been flooded to the ceiling, the terminal and power equipment completely submerged and telephone service entirely suspended. Before the day was over tools and material were in transit on taxicabs to the afternoon Baltimore & Ohio express for Wheeling. With this material went a number of men with the superintendent of installation. Their numbers were augmented by others from Philadelphia, Pittsburgh and other Pennsylvania points, and at noon of April 1 the entire party in motor boats, which had been chartered for the occasion, started down the Ohio River for Marietta, this being the only means of approaching the stricken district. The dispatch with which this particular case was handled by the Western Electric Company in performing its part in the restoration of the telegraph and telephone service of the country merits high tribute, not only to the company, but also to American business methods.

Great Demand for Linemen and Electricians in Devastated Districts.—Appeals have been sent out from the flood-stricken districts for all available linemen and electricians to aid in the work of making electrical repairs. There was a great deal of repair work to be done to electrical structures in a large area west of Chicago, owing to recent windstorms, and there is still more to be done in a still larger territory, generally east of Chicago, owing to the floods. As far as Duluth, Minn., the word was sent that "every man who can climb a telegraph pole and twist a wire is wanted at Dayton and other flooded cities in Ohio and Indiana." It is said that more than seventy-five men responded from Duluth alone. This widespread demand for linemen indicates in a way the extent of the damage done to telephone, telegraph and transmission lines in the flooded districts, because the States of Ohio and Indiana themselves furnish a large percentage of the linemen employed in the United States. Remarkable progress has been made toward restoring temporary communication in districts which have been entirely cut off from the outside world. The great task to be undertaken now is the replacing of temporary circuits with permanent lines. New poles have to be transported to the various districts to replace old ones which have been broken; poles have to be reset or righted, and hundreds of miles of wire have to be restrung. With the ground in its water-soaked condition, a considerable impediment will be offered to post-hole digging and the transportation of new poles to the scenes of erection in wagons. It is said that about 2500 outside linemen were sent by the Western Union and Postal companies to the devastated districts between Pittsburgh and Omaha. Where railroad transportation was interrupted, men and construction supplies were conveyed to the various districts by means of teams and automobiles.

Large Order for Electric Trucks.—The New York Railways Company has placed a hundred-thousand-dollar order with the General Vehicle Company for electric commercial vehicles as follows: One 1000-lb. wagon with express-type body, two 1000-lb. wagons with panel bodies, one 2000-lb. panel money wagon, fourteen 7000-lb trucks with steel dumping bodies and hand-operated dumping devices, four 3½-ton trucks with platform and stake bodies, one 5-ton truck with platform and stake body, and one 5-ton special truck. This order, in view of its magnitude, and coming from one company, may be regarded as a high indorsement of the electric truck, particularly when the wide range of duties which the trucks ordered will perform is taken into consideration. The 1000-lb. wagons will be used for special parcel delivery, while the money wagon ordered is a type already in use by express companies and banks. The fourteen 7000-lb. dumping trucks are to be furnished with the most modern equipment and will be the highest type of truck for the purposes for which they are designed. The 5-ton trucks will be used for cable work and the 3½-ton trucks will be used for general hauling.

Flood Causes Demand for Construction Tools.—One result of the damage to overhead electrical lines during the recent storm was a very great demand for construction tools. Urgent appeals were made to those in charge of stocks of this description in Chicago and elsewhere. The demand was especially great for digging tools, pike poles and the general line of construction tools. All kinds of overhead material were also in active demand.

Public Service Corporation of New Jersey Made Good Showing Last Year.—The annual report of the Public Service Corporation of New Jersey for the year ended Dec. 31, 1912, issued last week, shows that the corporation's subsidiary operating companies obtained an approximate gross increase from operating during the year of $2,200,000, which represents an increase of 7.31 per cent over the revenues from that source in 1911. The percentage of increase of the Public Service Railway Company was 4.35. This percentage, the report states, is below normal and is due to two reasons—the severe climatic conditions prevailing during the early winter months of 1912 and the direct loss suffered by the opening of the Summit Street, Jersey City, station of the Hudson & Manhattan Railroad Company, together with the joint operation by that company and the Pennsylvania Railroad Company of its high-speed electric line to Newark, N. J. The percentage of increased receipts of the Public Service Electric Company was 12.19, which is regarded as a most satisfactory showing, while the receipts of the Public Service Gas Company increased 8.50 per cent over those in 1911. President Thomas N. McCarter states, as he did in the 1911 report, that the most notable feature in relation to the development of the Electric company's business during the year was the vast increase in the amount of motor-service business obtained, and that merely the surface of the possibilities in this direction has been touched apparently thus far. During the year 1912 a large amount of new underground work was completed by the Electric company. Approximately $500,000 will be spent in the current year for additional underground work, in accordance with the policy of the company to place its wires underground in populous centers as rapidly as conditions will permit. Four new substations were finished during the year, and the rebuilding and enlargement of four other substations were completed. A very large and valuable piece of real estate has been secured during the year, fronting on the Passaic River in the meadow section of Newark, as the site for a new power station, which the rapidly growing business of the Electric company in this locality presages as a necessity in the early future.

Proposed Merger in Louisville.—The lower branch of the Louisville City Council has approved the proposed plan for merging the various heating and lighting properties in that city. The deal includes the consolidation of the two gas companies and four electric companies now operating independently. Interests headed by H. M. Byllesby, of Chicago, control two of the two larger companies, the Louisville Gas Company and the Louisville Electric Company, and also the two smaller electric companies, the George G. Fetter Lighting & Heating Company and the Campbell company. Options are also held on the other two concerns, the Louisville Heating Company, a natural-gas enterprise, and the Kentucky Electric Company. If the city gives its final approval, all these companies will be brought together under one organization, the Louisville Gas & Electric Company, incorporated a short time ago by Byllesby interests with an authorized capital of $18,000,000. The new franchises under which it is proposed to effect the merger call for a reduction in both electric and gas schedules. The proposition which has been made by the city provides for a sliding scale ranging from 7.6 cents to 4.75 cents per kw-hr. net for electricity, depending on the amount used. For gas $1.20 is to be the charge for the first 2000 cu. ft., with a minimum of 35 cents per 1000 cu. ft. for all gas above 2000 ft. and a minimum charge of 36 cents a month.

Changes Coming in Middle West Utilities Company.—Important changes affecting the Union Gas & Electric Company in both New Albany and Jeffersonville, Ind., as well as four electric railways operating in southern Indiana and a number of other Indiana central stations, are to be made when the Middle West Utilities Company, of Chicago, owning these properties, is reorganized. The proposed reorganization of the well-known Chicago company controlled by the Insull interests has been brought about by the recent enactment of a state law compelling all public-service corporations operating in Indiana to establish their headquarters in that State. It is expected that Chester P. Wilson, first vice-president of the Middle West Utilities Company and a resident of Indianapolis, will be elected president of the Chicago company. Its main offices will then be moved to the Indiana capital. Through the United Gas & Electric Company the Middle West interests will probably purchase the electric light and power plant in Corydon, Ind., in the near future, enabling them to serve Lanesville, Georgetown, Edwardsville and other points between Corydon and New Albany.

Receivers for Ohio Company.—Judge Day of the federal court for the Northern District of Ohio recently made Rees G. Richards and W. R. W. Griffin receivers for the Tri-State Railway & Electric Company. This receivership covers the Tri-State Railway & Electric Company and the operation of its leased properties, which are the East Liverpool Traction & Light Company and the Steubenville & East Liverpool Railway & Light Company. The receivership does not include or in any way interfere with the operations of the following properties: Beaver County Light Company, Midland Electric Light & Power Company of Pennsylvania, Steubenville, Wellsburg & Weirton Railway Company, Wellsburg Electric Light, Heat & Power Company and Hancock County Electric Company of West Virginia. The receivers are authorized by the court to carry on all current operation and pay all expenses of such operation from the revenues received.

Canadian Westinghouse Company's Year.—From the year's profits of the Canadian Westinghouse Company regular quarterly dividends at the rate of 7 per cent per annum and a bonus dividend of 2 per cent, making a total for the year of 9 per cent, have been paid, amounting to $399,762. Fifty thousand dollars have been added to the reserve for insurance fund purposes, which reserve now totals $100,000. The sum of $348,505 has been written off property and plant against items included in that account, consisting of factory equipment and manufacturing appliances of a more or less depreciating nature, and also against items not immediately productive from a manufacturing standpoint. The balance, amounting to $251,754, has been carried forward to the credit of the profit and loss account, which shows as of Dec. 31, 1912, a total unapportioned surplus of $1,302,599.37. The directors were all re-elected at the annual meeting.

Electrical Supply Dealers Open Offices in Canada.—The Perkins Electric Company, Ltd., which was recently organized to carry on business as dealer in and importer of electrical equipment, has opened offices at 322 Craig Street West, Montreal, Canada. The new company will act as wholesale dealer in and importer of flaming-arc, tungsten, carbon and sign lamps, miniature and automobile lamps, tumbler switches and switch plates, flexible conduit, flaming-arc, inclosed-arc and projection electrodes. Other lines will be added from time to time. George F. Perkins is president and managing director of the new company. F. G. Parsons is vice-president, P. F. Fergueson is secretary, and H. N. Howlett is accountant and assistant manager.

Connecticut Power Company to Build Plant.—The Connecticut Power Company, the Middletown Electric Light Company, the New London Gas & Electric Company and the Eastern Connecticut Power Company have been merged under the name of the Connecticut Power Company. It is understood that the new company will be managed by the Stone & Webster interests. A hydroelectric plant will be built at Falls Village, on the Housatonic River, and after its completion the company will issue $1,250,000 preferred stock, $1,000,000 common stock and $2,445,000 of bonds.

American Light & Traction Company Increases Capital Stock.—A certificate giving notice of an increase in its capital stock from $40,000,000 to $65,000,000 was filed with the Secretary of State, New Jersey, on March 31, by the American Light & Traction Company. The new issue is to be divided into $25,000,000 preferred and $40,000,000 common stock.

Change in Control of Lafayette (Ind.) Company.—Controlling interest in the Merchants' Electric Light Association, which does an electric lighting and steam heating business in Lafayette, Ind., has been acquired by Samuel T. Murdock, general manager of the Indiana Lighting Company, of Lafayette.

Texas Telephone Changes.—At a recent meeting of the Houston Home Telephone Company a number of changes in the personnel of the company were effected. J. B. Earle, of Walpole, who is president of the Brazos Valley Telegraph & Telephone Company, the South Texas Telephone Company, the Fort Worth Telephone Company, the United Telephone Company, the Ellis County Independent Company and the San Antonio Telephone Company, was elected president of the Houston company. As a result of the reorganization the Houston company will be brought into touch with the foregoing companies and a number of improvements in the service will be made. B. C. Hyde, of Waco, was elected vice-president of the company and E. C. Blomeyer, also of Waco, was made secretary and treasurer.

Electrical Manufacturers Open New York Office.—Messrs. Hickey & Schneider, manufacturers of electrical supplies, Elizabethport, N. J., concerning whose formation a note appeared recently in these columns, have opened a New York office at 227 Fulton Street, where M. D. Maxwell will be sales manager.

New Factory for National Quality Lamp Company.—According to advices from Cleveland, negotiations have been completed by the National Quality Lamp Division of the General Electric Company for the erection of a new factory in Cleveland, where 600 persons will be employed.

Will Represent Electric-Fixture Manufacturers.—The David Killoch Company, 57 Murray Street, New York, dealer in electric supplies, has been appointed Eastern agent for the S. W. Wakefield Brass Company, of Vermilion, Ohio, manufacturer of electric fixtures.

Triumph Electric Company Busy.—Owing to the pressure of orders at the works of the Triumph Electric Company, Cincinnati, Ohio, manufacturer of electric-light equipment, a night shift is working as well as the regular day force.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Mch. 26	April 2
Allis-Chalmers, t.r., 3d pd...	$15,501,800	.....	.....	2⅞*	3¼
Allis-Chal., pf., t.r., 3d pd...	14,115,500	.....	.....	7	7⅛
Amalgamated Copper.....	153,887,900	1½	Q	71½	73⅝
American Tel. & Tel.....	344,139,200	2	Q	133	132¾
Electric Storage Battery, c.	16,074,425	1	Q	50	51
General Electric.....	101,274,800	2	Q	137½	140⅜
Mackay Cos., c.....	41,380,400	1½	Q	81*	83½*
Mackay Cos., pf.....	50,000,000	1	Q	67⅞	67½
Western Union Tel.....	99,746,900	¾	Q	67	70
Westinghouse E. & M., c....	33,870,000	1	Q	63⅜	66
Westinghouse E. & M., pf...	3,998,700	1¾	Q	117*	117*

*Last price quoted.

NEW YORK METAL MARKET PRICES.

	March 25 Bid.	March 25 Asked.	April 1 Bid.	April 1 Asked.
Copper:				
Standard, spot	14.00	to 14.75	14.75	to 15.25
	£ s d		£ s d	
London, standard, spot	64 10 0		67 10 0	
Prime Lake	14.85	to 14.95	15.10	to 15.25
Electrolytic	14.85	to 14.95	15.10	to 15.20
Casting	14.65	to 14.75	15.00	to 15.10
Copper wire, base	16.00	to 16.25	16.25	
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	8.25		8.00	
Spelter, spot	6.10	to 6.20	6.00	
Tin, spot	46.50		48.00	
Aluminum:				
Prompt delivery	26.87½	to 27.12½	26.75	to 27.50
Future	26.62½	to 26.87½	26.75	to 27.50

OLD METALS.

Heavy copper and wire	14.00	14.25
Brass, heavy	9.00	9.37½
Brass, light	7.75	8.25
Lead, heavy	5.25	4.25
Zinc, scrap	5.25	5.12½

COPPER EXPORTS IN MARCH.

Total tons	41,702

Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding	DIVIDEND		LAST QUOTATION	
		Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	$9,500,000	.....	.....	13½	15½
Adirondack Elec. Power, pf...	2,500,000	.....	.....	49	53
Amer. Gas & Electric ($50), c..	2,500,000	2	Q	80	82
Amer. Gas & Electric ($50),pf.	1,537,500	1½	Q	45	45½
Amer. Light & Traction, c....	10,395,400	2½	Q	345	360
Amer. Light & Traction, pf...	14,236,200	2	Q	107	109
Amer. Power & Light, c.....	5,631,400	1	Q	70	72
Amer. Pwr. & Lt., 6% cum.pf.	5,631,400	1½	Q	83	84
Amer. Pwr. & Lt., opt. warr...	1,604,000	.....	.....	12	14
Am. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	99½	100
Appalachian Power, c.....	6,000,000	.....	.....	17	19
Appalachian Power, pf.....	2,180,000	.....	.....	60	62
Arizona Power, c.....	3,000,000	.....	.....	12	14
Arizona Power, pf.....	850,000	.....	.....	45	50
Asheville L. & P., 1st s.f.5s, '42	1,100,000	2½	S	92	95
Aug'ta-Aiken R.&E.,s.f.5s,'35	2,588,000	2½	S	89	92
Augusta-Aiken Ry. & Elec., c.	2,250,000	.....	.....	....	....
Augusta-Aiken Ry. & Elec.,pf	1,500,000	1½	Q	....	....
Augusta Ry. & El., 1st 5s, '40.	967,000	2½	S	100	102½
Central Maine Power, 1st, 5s...	2,502,000	2½	S	96	99
Cities Service, c.....	5,499,430	5–12	M	115	120
Cities Service, pf.....	10,195,360	½	M	86	88
Col'bus R. Gas&El.,1st5s,'36..	2,454,000	2½	S	92½	95
Columbus Ry., G. & Elec., c...	2,000,000	.....	.....	60	....
Columbus Ry., G. & Elec., pf..	840,000	1½	Q	85	95
Commonw.Edison, cap.stock.	37,764,140	7	A	142½	139½
Con. Gas, El. & Pr. (Balt.),4½s	11,564,000	2¼	S	86	87
Consum. Pwr. (Mich.),5s,'36..	10,088,000	2½	S	94½	97½
Consum. Pr. (Minn.),1st 5s,'29	9,528,000	2½	S	87	89
Dallas Elec. Corp., 5s, '22.....	3,659,000	2½	S	94	97
Denver Gas & El. Lt., c.....	7,001,300	¼	M	220	....
Denver Gas & El. Lt., gen. 5s.	6,000,300	2½	S	94	95
Edi. El. Ill., Boston,cap.stock.	15,603,700	3	Q	281	280
Federal Light & Traction, c...	4,750,000	.....	.....	30	32
Federal Light & Traction, pf..	2,500,000	1½	Q	78	80
Fort Worth Pwr. & Lt., 1st 5s.	1,500,000	2½	S	94	96
Harwood Electric, 5s, '39.....	1,000,000	2½	S	101½	103
Kansas City Rwy. & Lt., c....	9,543,080	.....	.....	14	20
Kansas City Rwy. & Lt., pf...	9,407,500	1½	Q	35	40
Kan. City R.&Lt., 1st ref.5s...	10,200,000	2½	S	89½	91
Kan. City R. &Lt.,con.6s,'12..	5,478,000	3	S	88	90
Lincoln Gas & Electric, c.....	2,250,000	.....	.....	28	32
Lincoln Gas & Electric, 5s, '41	796,000	2½	S	85	89
Northern States Power, c....	5,975,000	.....	.....	21	22
Northern States Power, pf...	8,386,700	1¾	Q	83	84
Pacific Gas & Electric, c.....	31,908,750	1½	Q	57	58
Pacific Gas & Electric, pf.....	10,000,000	1½	Q	91	91½
Philadelphia Electric ($25)...	24,987,750	1½	Q	23	23
Portland General Electric, 5s.	8,000,000	2½	S	99	101
Republic Railway & Light, c...	5,200,000	.....	.....	22	24
Republic Railway & Light,pf.	6,360,000	1½	Q	70	77
St. Joseph's R., L., H. & P.,5s.	4,637,000	2½	S	98	99
Seattle Electric Co.,con.5s,'29.	7,417,000	2½	S	97	99
Southern Calif. Edison, 5s,'39.	10,043,000	2½	S	95	98
Southern Power, 5s.....	5,000,000	2½	S	98	100
Standard Gas & Elec. ($50),c.	9,343,150	.....	.....	17¾	18½
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	47	47½
Tennessee R., L. & Powr., c...	20,000,000	.....	.....	19½	21
Tennessee R., L. & Pwr., pf...	10,250,000	1½	Q	75½	76½
Tri-City Railway & Light, c...	9,000,000	.....	.....	62	66
Tri-City Railway & Light, pf..	2,826,200	1½	Q	93	95
Virginia Railway & Power, 5s.	10,345,000	2½	S	93½	94½
Western Power.....	14,670,000	.....	.....	19	21
Western Power, 6% cum. pf...	6,000,000	6	A	49	52
Western States Gas & El., c...	3,503,000	.....	.....	45	50
Western States Gas & El., pf..	1,800,000	1¾	Q	88	93
W. Sta's G. & E.,1st&r.5s,'41.	3,400,000	2½	S	94½	96

Personal

Mr. H. D. Beaumont has been appointed superintendent of the Hearne (Tex.) municipal plant.

Mr. J. M. Bramlette is the successor to Mr. J. H. Humpe as manager of the Lincoln Traction Company, Lincoln, Neb.

Mr. G. M. Ronanan is the successor to Mr. C. F. Appleton as treasurer and manager of the Dublin (N. H.) Electric Company.

Mr. Adolf Wagner has succeeded Mr. H. D. Hayden as manager of the Red Wing (Minn.) Gas, Light & Power Company.

Mr. F. C. Kimball has been appointed to fill the office of manager of the Commonwealth Water & Light Company, Summit, N. J.

Mr. Orlando McClure has resigned as superintendent of the Idlewild Electric Light, Heat & Power Company of Federalsburg, Md.

Mr. W. G. Ghiselin has been appointed manager of the St. Charles (Mo.) Electric Light & Power Company, succeeding Mr. W. S. Merkle.

Mr. William Gorenflo is the new president of the Columbia Ice & Power Company, Columbia, Miss., having succeeded Mr. C. W. Grayson.

Mr. Colin K. Lee, formerly of Kansas City, Mo., has become manager of the Pike County Electric Light & Power Company of Bowling Green, Mo.

Mr. A. M. Little, manager of the Mohawk Electrical Supply Company of Syracuse, N. Y., has been elected a vice-president and director of the company.

Mr. George F. Morrison, general manager of the General Electric Company's works at Harrison, N. J., has returned from an extended trip to Japan.

Mr. E. G. Taylor combines the duties of president and manager of the Loup City (Neb.) Mill & Light Company, which has recently entered the lighting field.

Mr. Judson E. Strong, of Chicago, Ill., has been appointed manager for the Central Illinois Public Service Company at Pittsfield, Ill., succeeding Mr. Frank R. Harder, resigned.

Mr. Harry E. Dauner is now new-business manager for the Fremont Gas, Electric Light & Power Company of Fremont, Neb. Mr. Dauner was formerly stationed at Pueblo, Col.

Mr. A. J. Mueller has been appointed manager and superintendent of the National Light, Heat & Power Company, Brainerd, Minn., which took over the municipal electric-lighting plant at that place.

Mr. J. T. Shannon has been appointed commercial agent for the United Electric Light & Water Company of New Britain, Conn. Mr. Shannon was formerly stationed at Waterbury, Conn., Harrison, N. J., and Nashville, Tenn.

Mr. Mason D. Pratt has joined the staff of the United Railways & Electric Company of Baltimore, Md., as engineer under Mr. J. M. Hood, consulting engineer. Mr. Pratt formerly had a consulting engineering practice at Harrisburg, Pa.

Mr. A. L. Thorn, formerly superintendent of electric works at Tacoma, Wash., has been transferred to the commercial department which the city recently established, and will devote his time to the sale of energy for motors, heating and lighting.

Mr. Albert L. Pearson, electrical engineer for Lockwood, Greene & Company, Boston, Mass., addressed the meeting of the American Society of Mechanical Engineers at the Boston Engineers' Club, March 25, on the subject of industrial illuminating engineering.

Mr. William L. Wilson, president of the Wilson-Maltman Electric Company, of Baltimore, was the speaker at the weekly luncheon of the Jovian Order of Baltimore, held at the Hotel Emerson March 27. His subject was "Co-operation from a Contractor's Standpoint."

Mr. O. B. Nelson has become manager of the Colonial Power Company, with offices at Claremont, N. H., succeeding to the control of the Claremont Railway & Lighting Company and the Claremont Power Company, of which Mr. L. N. Wheelock was formerly manager.

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, addressed the Jovian luncheon held at Philadelphia, March 27, outlining the aims and objects of the society and suggesting directions in which the Jovian Order and the society can work together for mutual aid to the industry.

Mr. H. L. Lincoln, formerly in the contract department of the Commonwealth Edison Company, Chicago, has been appointed instructor-in-charge of the new Chicago Central Station Institute, recently established at 1120 Merchants' Loan & Trust Building, Chicago, for the training of central-station commercial men.

Mr. Louis A. Alexander, superintendent of the F. Bissell Company, Toledo, Ohio, addressed the members of the Toledo Section of the American Institute of Electrical Engineers at a recent meeting, taking for his theme the technical features of high-speed motors in the operation of vacuum cleaners and pumps.

Mr. J. G. Pomeroy, who for seventeen years was manager of the Chicago office of the Adams-Bagnall Company, and later in charge of the Cleveland headquarters, has joined the forces of the Illinois Electric Company, with offices at Los Angeles. Mr. Pomeroy has been in Southern California on a vacation since the early fall of 1912.

Mr. B. W. Collins, who has been appointed superintendent of the Tacoma (Wash.) electric works, was formerly manager of the Northwestern Supply Company and the Pacific Lamp & Supply Company of Tacoma. Previous to his Tacoma connections, Mr. Collins was general superintendent of the Monterey County Gas & Electric Company, of Monterey, Cal.

Mr. Nils Sundblad, who is in charge of hydraulic construction work at the Trollhättan power station, Sweden, and also of the extensive reconstruction of the ancient Göta Canal at Trollhättan, is at present visiting this country to study recent developments in the hydraulic features of power-plant design. Mr. Sundblad expects to remain in this country about three months.

Mr. H. C. Eddy, recently appointed engineer of the public utilities commission for the District of Columbia, received his technical training at Lehigh and Columbia universities, and after experience in power-plant operation for several New Jersey electric railways, joined the staff of J. G. White & Company as electrical engineer and assistant superintendent. In this connection he installed an extensive street-railway system at Auckland, New Zealand. Later he became superintendent of underground construction for the Potomac Electric Power Company of Washington, resigning to fill the appointment of assistant electrical engineer for the District of Columbia. From 1908 until the creation of the public utilities commission by Congress, March 4, 1913, Mr. Eddy served as executive officer for the Interstate Commerce Commission which had jurisdiction over the Washington utilities.

Obituary

Charles E. Wilson, general manager of the Keystone Telephone Company of Philadelphia, died at his home in that city March 29. Mr. Wilson was forty-five years of age and had been ill for several months.

John Cashman, president of the Quincy Electric Light & Power Company, of Quincy, Mass., died at his home in West Quincy March 29. Mr. Cashman was a citizen of much public spirit and built the monument to the Pilgrims at Provincetown.

C. Edgar Titzel, manager of the Lancaster Edison Electric Company and the Lancaster County Railway & Light Company, of Lancaster, Pa., and the Columbia Light, Heat & Power Company of Columbia, Pa., died at Lancaster, Pa., March 30 of paralysis caused by a hemorrhage of the brain. Mr. Titzel was thirty-nine years of age at the time of his death and had been in the employ of the local electric companies twnty-four years.

Construction

New England

WESTBROOK, MAINE.—Work has begun on the construction of the new power house of the Presumpscot El. Co., of Westbrook, at Dundee, on the Presumpscot River. The Aberthaw Construction Co., of Boston, Mass., has the contract.

RUTLAND, VT.—A merger of public utilities companies in southern Vermont and New Hampshire has been announced. The new company is to be known as the Eastern Pwr. & Lt. Co. and will include the Rutland Ry., Lt. & Pwr. Co., the Colonial Pwr. & Lt. Co., recently formed, the Clarendon Pwr. Co., the Springfield Lt. & Pwr. Co., the Cavendish Pwr. Co., the Manchester El. Co., the Claremont El. Co. and Pennsylvania and Western concerns. Improvements and extensions involving an expenditure of $1,000,000 are contemplated, including a 6000-hp plant at Clarendon. Transmission lines will be erected from Clarendon to Wells, and through to the New York State boundary line, extending to West Fawlet and Rupert; another line will extend from Clarendon through Wallingford to Manchester, while still another will be built to Cavendish, connecting with a 2000-hp hydraulic plant on the Black River about a mile south of Cavendish, and extending thence to Springfield. A line will also be erected from Cavendish across the Connecticut River to Claremont, N. H. The Eastern Pwr. & Lt. Co. is capitalized at $20,000,000. The Rutland Ry., Lt. & Pwr. Co. will also be connected with the circuit, via the Clarendon plant.

BEVERLY, MASS.—The Beverly Gas & El. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue 2500 shares of additional capital stock to provide funds for improvements to its plant, extension of its system and for continuing the work of placing wires underground.

BRIMFIELD, MASS.—At the annual meeting held recently it was voted to light the streets of the town with electricity. It was decided to enter into a contract for a period of five years, at an annual cost of $750, which will provide street lamps for Brimfield and East Brimfield.

GREENFIELD, MASS.—The Amherst Pwr. Co. is building a transmission line from its power station at Turners Falls through Amherst and down to Chicopee. This line will probably be extended across the Connecticut River and down through West Springfield. The transmission line is completed as far as Amherst and will be finished to the Connecticut River by June. The line consists of two three-phase circuits operating at 66,000 volts and erected on a single line of steel towers. Contracts have been awarded for the Chicopee substation and for all apparatus, which will consist at present of outdoor, oil-cooled transformers, stepping down from 66,000 volts to 13,200 volts, also outdoor oil switches and lightning arresters and disconnecting switches on the 66,000-volt side of the transformers. There will be one bank of three 1500-kw, single-phase transformers, with one spare, installed at present, with a space for two more similar banks; also two 500-kw synchronous motor-generator sets with space for third, which will supply energy to the Springfield Street Ry. Co. in Chicopee. The station is arranged for an ultimate output of 15,000 kw. The company is also building a substation at Amherst which will be a sectionalizing station in the transmission line and will also be equipped with transformers and local distributing apparatus for electricity to be furnished the Amherst Gas Co. The water-power plant at Turners Falls will be relayed by a steam plant of the Greenfield El. Lt. Co. at Greenfield, and by one of the East Hampton Gas Co. at Mount Tom. A branch 66,000-volt circuit will run from the Amherst substation to the Mount Tom steam station. The officers are: Philip Cabot, president; Lester E. Flint, treasurer, both of 111 Devonshire Street, Boston; George W. Lawrence, general manager, and F. L. Hunt, chief engineer, both of Greenfield, Mass.

LYNNFIELD, MASS.—The State Board of Gas and Electric Light Commissioners has authorized the Lynn Gas & El. Co., of Lynn, to distribute and sell electricity and gas in Lynnfield.

MILFORD, MASS.—A committee has been appointed to ascertain the cost of the local electric-light plant, owned by the Milford El. Lt. & Pwr. Co., with a view to its purchase by the town.

SPRINGFIELD, MASS.—It is understood that the ornamental lamps on Court Square will be replaced with higher power lamps. New standards of more graceful design and greater height and cluster lamps of higher candle power will be installed as soon as the ornamental lamps on the north side of West Court Street are ready. The present standards were furnished by the United El. Lt. Co., of Springfield.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co., of Turners Falls, has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $20,000 in additional capital stock, the proceeds to be used for paying outstanding indebtedness and further additions to its plant.

WEST SPRINGFIELD, MASS.—The special lighting committee appointed to consider the advisability of selling the municipal lighting equipment to the United El. Lt. Co., of Springfield, or improving it, will ask for an appropriation for improvements to the system at the next town meeting. The cost of the work is estimated at about $15,500.

WILLIAMSTOWN, MASS.—Plans are being prepared for the installation of an electric-light plant to supply electricity for lamps and motors for all the college buildings, including dormitories, of Williams College. The present steam-heating plant is so arranged that electrical equipment can be added. Electrical service is now furnished by the Williamstown Gas Co.

FALLS VILLAGE, CONN.—The Connecticut Pwr. Co., of New Haven, the Middletown El. Lt. Co., of Middletown, and the New London Gas & El. Co., of New London, have been consolidated under the name of the Connecticut Pwr. Co. The Connecticut company also owns the Berkshire Pwr. Co., of Canaan, and plants in Norfolk and Sharon. It is proposed to develop at once a hydroelectric power plant at Falls Village, on the Housatonic River. This plant, utilizing the entire flow of the Housatonic River at Great Falls with an effective head of 90 ft., will ultimately develop 16,000 hp. Equipment for 12,000 hp will be installed this year. Transmission lines carried on steel towers will be erected from Falls Village through Torrington to Thomaston and thence to Bristol, with possible extension to Middletown. The Connecticut Pwr. Co. will be under the management of the Stone & Webster Management Association, of Boston, Mass.

Middle Atlantic

ALBANY, N. Y.—The Murtaugh bill authorizing the State Conservation Commission to erect a plant at the barge canal dams at Vischer's Ferry and at Crescent on the Mohawk River for the development of electrical energy from the surplus waters of the barge canal was passed by the Senate on March 27. The bill carries an appropriation of $650,000.

BATAVIA, N. Y.—The Genesee Lt. & Pwr. Co., of Batavia, is building another story to its transformer station on Ellicott Street. A large electric crane will be placed on the building when completed.

BUFFALO, N. Y.—Sealed proposals will be received by the commissioner of public works, Room 5, Municipal Building, Buffalo, until April 11, for furnishing material and construction of a new 16-room fireproof school building on Sears Street, near Broadway. A separate and distinct proposal must be made for each of the following divisions of the work: (a) Masonry, concreting, plastering, etc.; (b) structural iron and steel work, stairways, etc.; (c) fireproofing, floors, partitions, roofs, etc.; (d) carpentry, mill work, painting, hardware, etc.; (e) roofing, sheet-metal work, etc.; (f) electrical work, telephone system, lighting fixtures, etc.; (g) heating, ventilating, radiation, etc.; (h) plumbing, drainage, gas-fitting, etc. Plans and specifications may be seen at the office of the deputy building commissioner, Room 6, Municipal Building, where blank form of proposals and other information can be obtained.

COBLESKILL, N. Y.—Sealed bids will be received at the office of Seward H. Van Ness, secretary, Cobleskill, until April 10 for the construction of new high school building, plans for which were prepared by William T. Towner, architect, 320 Fifth Avenue, New York, N. Y., from whom further information may be obtained. Bids will also be received at the same time and place for the heating, ventilating, plumbing and electrical work for the building. Plans and specifications may be seen at the office of the secretary, Cobleskill, and at the office of the architect.

ELMIRA, N. Y.—The Elmira Wtr., Lt. & R.R. Co. is planning to build a new power station.

GLOVERSVILLE, N. Y.—The Fulton County Gas & El. Co., of Gloversville and Johnstown, has applied to the Public Service Commission for permission to issue $28,000 in notes, the proceeds thereof to be used as follows: New business for gas service, $5,000; new pressure mains, $1,500; new business extensions for electrical services, $23,000; $5,000 for street-lighting in Johnstown. Other extensions and improvements will be made, costing in all $61,487, but the company has on hand funds to the amount of $32,978 to apply toward these expenditures.

JAMESTOWN, N. Y.—The Board of Municipal Lighting Commissioners has asked the Common Council to call an election to vote on a proposition to issue $38,000 in bonds, the proceeds to be used for the installation of a 750-kw turbo-generator set in the municipal electric-light plant, the erection of two additional street-lighting circuits and mechanical stokers. Equipping the Buffalo Street water-works pumping station is also suggested; if this improvement is made, it will probably wait on the other extensions.

NEW YORK, N. Y.—The New York Athletic Club is contemplating the installation of new power plants or rebuilding the present plants in the club house at Fifty-ninth Street and Sixth Avenue, New York, and at Travers Island. William H. Page is president of the club.

PHOENIX, N. Y.—At an election held March 18 the proposition to replace the present arc-lamp street lighting with incandescent lamps was carried.

PLEASANT VALLEY, N. Y.—At an election held recently the proposition to install a street-lighting system here was carried. The plans provide for 25 street lamps which will be installed as soon as arrangements can be made.

SCHENECTADY, N. Y.—The city of Schenectady has submitted a proposition to the Schenectady Illg. Co. relative to furnishing electricity for pumping water at the Rotterdam wells. In the proposed agreement the city asks authority to establish two distinct pumping stations, one for the section of the city below Nott Terrace, the other for the district above that street.

SENECA, N. Y.—The West Seneca Town Board has decided to create a lighting district including Ebenezer, Gardenville, Winchester and the section of the township extending from the city line out on Seneca and Clinton Streets to the southerly limits of the villages of Ebenezer and Gardenville. The proposed lighting system provides for about 350 electric lamps. The board will ask for bids for furnishing, installing and maintaining the system, which will be opened in about 30 days.

SYRACUSE, N. Y.—The Syracuse Ltg. Co. has applied to the Public Service Commission for permission to issue $239,000 in bonds, the proceeds to be used for extensions to its system in Syracuse.

TROY, N. Y.—The city of Troy contemplates the installation of an ornamental street-lighting system, to cost $67,000, during 1913. The plans provide for the installation of 310 standards, each carrying five Mazda lamp clusters. The installation of a fire-alarm, telegraph and police-signal system, at a cost of $98,000, is also contemplated. Paul Schultze is city engineer.

ALLENTOWN, PA.—Terms have been agreed upon by which the Lehigh Valley Transit Co., of Allentown, will purchase power from the Lehigh Navigation El. Co., instead of adding to its own power plant as first contemplated. The contract will start with 5300 kw and increase in four years to 9000 kw. With the initial installation of 30,000 kw the Hauto power plant of the Lehigh Navigation El. Co. is expected to be ready to go into operation in June.

PITTSBURGH, PA.—The West Penn Ry. Co. is planning to extend its service through the Ligonier Valley and supply an electric railway service and electricity for lamps, heaters and motors. The company is also planning to serve various coal and sand developments in that district.

PITTSBURGH, PA.—Notice has been filed that applications will be made on March 31 to Governor Tener for charters for 43 electric-light companies for the purpose of distributing electricity in cities, townships and boroughs throughout the city of Pittsburgh and its environs in the Monongahela and Allegheny valleys as follows: Pittsburgh, McKeesport, Glassport, North Braddock, Pitcairn, Wilson, Etna, Wilmerding, Swissvale, Trafford, Braddock, Rankin, Hays, Sharpsburg, Millvale, East Pittsburgh, Wilkinsburg, Edgewood, Verona, East McKeesport, Munhall, West Homestead, Homestead, Port Vue, Clairton, Duquesne, Turtle Creek and Wall, and the following townships: Mifflin, Penn, Shaler, Braddock, Wilkins, Patton, Indiana, Spring Garden, Reserve, Whitaker, North Versailles, Versailles and South Versailles. The incorporators are A. C. Christiansen, R. E. Anderson and M. G. Deeley. Thomson & Thomson, Bakewell Building, Pittsburgh, are attorneys for the petitioners.

READING, PA.—The Metropolitan El. Co., of Reading, has started work on placing all of its wires underground. The cost of the work is estimated at $700,000.

SHARON, PA.—The contract for street lighting with the Shenango Valley El. Lt. Co. for a period of five years has been signed. Under the terms of the contract the company is to furnish arc lamps at $48 per lamp per year, and is to replace the present arc lamps with flaming-arc lamps by May 1.

CLEMENTON, N. J.—The Public Service Co. is contemplating extending its electric traction system across Clementon Lake.

JERSEY CITY, N. J.—The Public Service El. Co. has been granted permission by the building department to build an addtiion to its Marion power station on Duffield Avenue, to cost about $80,000.

MONTCLAIR, N. J.—Bids will be received until April 14 by Harry Tripp, town clerk, Room 3, Crane Building, Montclair, for fire-alarm system, cable and connections to be laid in conduits already provided on Bloomfield Avenue and other streets in the town of Montclair in accordance with plans and specifications on file in the office of Edgar S. Closson, town engineer, Room 5, Crane Building, Montclair. The cost of the work is estimated at $5,000.

NEWARK, N. J.—The Public Service Corporation has purchased a large site on the Passaic River in the meadow section of Newark as a site for a new power station, which, it is said, will take the place of the electric light and power stations on River Street and at the city dock and also supplement the station at Marion. The proposed plant will supply electricity in Essex County and part of Union County. An addition is being built to the Marion plant.

SUMMIT, N. J.—The capital stock of the Commonwealth Wtr. & Lt. Co., of Summit, has been increased from $1,000,000 to $3,000,000, to provide for extensions to its business. The company has acquired the property of the Point Pleasant El. Lt. & Pwr. Co., which serves Point Pleasant, Bay Head, Spring Lake and vicinity.

WILMINGTON, DEL.—The People's Ht., Lt. & Pwr. Co., recently incorporated, has applied to the directors of the Street and Sewer Department for a franchise to erect transmission lines and to lay conduits in the streets of the city for the distribution of electricity for lamps and motors.

BALTIMORE, MD.—Two additions will be made to the plant of the Consolidated Gas, El. Lt. & Pwr. Co., at the corner of Carey and Wicomico Streets, to cost $25,000.

WHEELING, W. VA.—The Eastern Pwr. & Lt. Corpn., recently organized with a capital stock of $20,000,000, has acquired the public utilities in Wheeling, including the Suburban Lt. & Wtr. Co. and the City and Suburban Gas Co. The company will be operated by W. S. Barstow & Co., 50 Pine Street, New York, N. Y.

COVINGTON, VA.—The Town Council has adopted an ordinance providing for the granting of a franchise for the installation of an electric-light plant and distributing system for a period of 30 years, bids for which will be received until May 5, 1913. W. C. Wright is clerk of Council.

North Central

ALBION, MICH.—The City Council is considering the installation of a municipal electric-light plant.

ANN ARBOR, MICH.—Gardner S. Williams, Cornwell Building, Ann Arbor, will receive bids in the near future for the construction of a power plant and dam at the Argo plant, near Ann Arbor, for the Eastern Michigan Edison Co.

BAY CITY, MICH.—The City Council has approved the report of the committee recommending the purchase of two 400-hp Wickes boilers and a 750-kw Allis-Chalmers turbo-generator set for the municipal electric-light plant. The People's Savings Bank and the Fisher Land Co. have applied to the Council for permission to erect ornamental street lamps similar to those in use in Wenonah Park in front of their buildings.

BELDING, MICH.—The Richardson Silk Co. has completed the installation of a 320-kw electric generator to furnish electricity for lighting its mill and boarding house. The company proposes to extend its wires to connect with other silk mills to furnish energy for lamps and motors. Fred A. Washburn is superintendent.

BELLEVILLE, MICH.—Gardner S. Williams, engineer, Cornwell Building, Ann Arbor, is preparing plans and will receive bids in the near future for the construction of a power plant and dam at Belleville for the Eastern Edison Michigan Co., of Detroit.

CARSONVILLE, MICH.—The taxpayers have voted in favor of installing a municipal electric-light plant.

ECORSE, MICH.—The Eastern Michigan Edison Co. is planning to install an electric-lighting system in Ecorse. The village is now served by a gas plant.

GRAND RAPIDS, MICH.—The cost of installing an ornamental street-lighting system on Ionia Avenue from Oakes Street to Lyon Street is estimated at $8,520. The plans provide for 71 lamp standards at $120 each.

HOUGHTON, MICH.—J. K. Gronhold, of St. Louis, Mo., engineer, for Vielem, Blackwood & Buck, of New York, N. Y., promoters of the Sturgeon River Land & Devel. Co., which proposes to erect a hydro-electric power plant on the Sturgeon River, is preparing to make surveys for the proposed transmission lines to distribute electricity throughout the copper country, covering about 43 miles.

CINCINNATI, OHIO.—Preparations are being made for the erection of a large power building by the Scarborough estate at the corner of Seventh Street and Broadway, Cincinnati. A large electric plant will be installed in connection with the proposed building. J. V. B. Scarborough is agent for the estate.

CLEVELAND, OHIO.—Steps will soon be taken toward connecting the patrons of the three small municipal lighting plants with the $2,000,000 plant at the foot of East Fifty-third Street. Ducts will be laid for two miles in Lakeside Avenue Northeast for the cable from the East Fifty-third Street station on Lakeside Avenue east of Ninth Street. F. W. Ballard is constructing engineer of the city lighting department.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of the secretary to the director of public service, Room 104, City Hall, Cleveland, Ohio, until April 10, for furnishing steam engine and generator for the Collinwood station of the municipal electric-light plant, specifications for which may be obtained at the office of the engineer of construction, Room 319, City Hall. W. J. Springborn is director of public service and W. H. Kirby is secretary to the director.

ELYRIA, OHIO.—The large dam at East Falls owned by the Elyria Milling & Pwr. Co. has been carried away by the flood.

LINDSEY, OHIO.—The Sandusky County Commissioners have granted the village of Lindsey permission to erect transmission lines on the road leading from the Lake Shore El. Ry. Co.'s right-of-way on the pike to the village, a distance of 2 miles. Work will begin at once on the construction of the Lindsey plant.

PUT-IN BAY, OHIO.—The Put-In Bay Improvement Co., of Put-In Bay, has decided to install a new electric light and power plant, bids for which have already been received. The proposed plant will cost about $16,000 and will have sufficient output to maintain 22,000 lamps.

SHAWNEE, OHIO.—The American Gas & El. Co., of New York, N. Y., has acquired a controlling interest in the People's El. Lt. & Pwr. Co., of Shawnee, the Perry El. Co., of Crooksville, and the New Lexington El. Lt. & Pwr. Co., of New Lexington. The company now controls in addition to the above the electric light and power companies of Mount Vernon, Coshocton, Newark, Lancaster and Logan. A power plant is now being erected in Newark to supply electricity for lamps and motors to all these cities and intermediate points.

LOUISVILLE, KY.—Designs for the electric-lamp standards to be placed at intervals along Eastern, Western and Third Street Parkways and in Central Park, as submitted by the Louisville Ltg. Co., have been

accepted by the Board of Park Commissioners. The standards for the parkways are to be 26 ft. in height, each with concrete base and metal extensions, surmounted by a 200-cp lamp. Those selected for Central Park are of the goose-neck type. Bids have already been asked for electricity to maintain the lamps.

SOMERSET, KY.—The Kentucky Utilities Co., of Lexington, which recently purchased the local electric-light plant, water-works and street-railway systems, is installing new machinery at the power plant to provide power for the new filtration plant which is being installed and also to furnish electricity in the town of Burnside, 7 miles distant.

WHITESBURG, KY.—Plans are being considered for the installation of an electric-light plant here. Wesley Wright, of Wright & Chase, of Jenkins, is interested.

WILLIAMSTOWN, KY.—The Williamstown Mill & Lt. Co. is installing a 35-kw alternating-current generator and electric distributing system for the purpose of furnishing electricity for street and commercial lighting. Power to operate the plant will be furnished by a 50-hp gas engine which operates the mill. The contract for the entire work has been awarded to Ellis G. King, of Williamstown and Falmouth. J. W. Shields is president and manager of the company.

RUSHMORE, IND.—The installation of an electric-lighting system in Rushmore is under consideration.

ABINGTON, ILL.—The plant and holdings of the Abington Lt. & Pwr. Co. have been purchased by the Galesburg Ry. & Lt. Co., of Galesburg. A transmission line will be erected to connect the two properties, and the Abington plant will be converted into a substation for distributing electricity in this locality.

ALEDO, ILL.—The Tri-Counties El. Lt. Co., with offices in Aledo, has entered into contracts to furnish electricity in Aledo, Alexis, Viola, New Boston, Joy, Keithsburg, Seaton, New Windsor, Alpha and Rio.

ALTON, ILL.—Surveys are being made for the proposed high-tension transmission line to furnish electricity for the Alton Gas & El. Co. from the plant of the Mississippi River Pwr. Co. at Keokuk, Ia. The line will follow the route of the Alton, Jacksonville & Peoria Railway. The Mississippi River Pwr. Co. will supply energy to the Alton, Jacksonville & Peoria Ry. Co. and also to the Pisa Lt. & Pwr. Co., Alton.

CENTRALIA, ILL.—The City Council contemplates the installation of ornamental lamps on seven blocks. Lee S. Trainor is city engineer.

CHARLESTON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, proposes to erect 20 ornamental street lamps around the public square.

CHICAGO, ILL.—The Northwestern El. Co., of Chicago, has increased its capital stock from $25,000 to $100,000.

CHICAGO, ILL.—Plans have been submitted to Mayor Harrison by City Electrician Ray Palmer for extensions to the street-lighting system which provide for the installation of 48,000 flaming-arc lamps within the next five years. Mr. Palmer advises a new contract with the Sanitary District of Chicago for the installation of 10,000 additional arc lamps immediately at a cost of $2,040,000, and the furnishing of all its available electric energy which can be used for public lighting and other purposes; also a contract with the Commonwealth Edison Co. for emergency throw-over service and for additional energy necessary for municipal purposes which cannot be supplied by the Sanitary District plant. The present contract for 10,000 lamps has practically been fulfilled.

DECATUR, ILL.—The property owners on West Macon Street have started a movement for the installation of an ornamental street-lighting system.

MATTOON, ILL.—The electric-light plant of the Central Illinois Pub. Serv. Co., of Mattoon, in Kincaid, now in course of construction, was damaged by a windstorm March 23, causing a loss of about $6,000.

MOUNT PULASKI, ILL.—The City Council has granted West & Veall, owners of the local electric-light plant, a 35-year franchise. It is proposed to enlarge the plant and extend the service to neighboring towns.

MONMOUTH, ILL.—The City Council has appointed a committee, consisting of Aldermen Giltner, Strand and Costello, to confer with M. A. Walsh, vice-president of the Rock Island Southern Ry. Co., regarding a plan to transmit electricity from the company's power house on its northern line to Monmouth.

ONARGA, ILL.—The Village Board has passed an ordinance revoking the franchise of the Northern Indiana Utilities Co., which was granted recently for the purpose of operating an electric-light plant in Onarga.

RIVERSIDE, ILL.—Bids will be received by the town of Riverside, Town Hall, Riverside, until April 14, for furnishing material and constructing a water-works system as follows: For three 700-gal. per minute, motor-driven centrifugal pumping units, cast-iron piping, switchboard, wiring appurtenances and machinery necessary; 150,000-gal. steel water tank with gallery and appurtenances, pumping-station building and masonry tower for water tank. Contracts to be let separately or together. Plans and specifications may be obtained at the office of D. H. Maury, consulting engineer, 1137 Monadnock Building, Chicago, or from C. D. Sherman, city clerk.

SPRINGFIELD, ILL.—The cost of installing the ornamental street-lighting system on Fourth Street is estimated at $11,200. The property owners along the street are to pay for the installations of the lamps and the city will furnish electricity to maintain them.

VIRDEN, ILL.—The Virden El. Lt. Co. is erecting a transmission line to Girard, where it will furnish electricity for lamps and motors.

BRAINERD, MINN.—A proposition has been submitted to the Council by M. D. Stoner, president of the Cuyuna Range Pwr. Co., of Deerwood, offering to furnish electricity to the city of Brainerd from its dam on the Crow River, the present plant to be used as an auxiliary.

WINDOM, MINN.—The town of Windom is planning to install a new municipal electric-light plant and establish a day service.

WINONA, MINN.—The property of the Winona Ry. & Lt. Co., including electric-lighting plant and street-railway system, has recently been taken over by the Wisconsin Ry., Lt. & Pwr. Co.

CEDAR RAPIDS, IA.—At an election held recently the proposition to grant the Cedar Rapids & Iowa City Ry. & Lt. Co. a new 25-year franchise was carried. The company proposes to make eight extensions and double-track its lines this year. The cost of the work is estimated at about $250,000.

CLINTON, IA.—Plans will be prepared at once by the Clinton Gas & El. Co. for the reconstruction of its electric-light plant and distributing system in the business district and eliminating poles from Second Street. Improvements will also be made to the gas plant.

DES MOINES, IA.—The Board of Supervisors is contemplating the purchase of bronze electroliers (at a cost of $700 each) to be placed at the entrances of the county building. Eight electroliers will be required, making the total cost $5,600.

ELDRIDGE, IA.—The citizens of Eldridge have petitioned the Town Council to take steps to secure the installation of an electric-light system here.

HAMPTON, IA.—The local electic-light plant, owned by J. J. Roe, has been purchased by H. H. Coughlan, of Waterloo, and M. A. Harrison, of Nevada. The new owners will take possession of the plant at once and propose to rebuild the plant and install new equipment.

JESUP, IA.—At a special election held recently the proposition to grant a franchise to H. C. Young and Charles Brush to construct and operate an electric-light plant in Jesup was carried.

LE MARS, IA.—At an election held recently the proposition to purchase the plant of the Le Mars City Wtr. & Lt. Co. was defeated.

LE MARS, IA.—Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until April 22 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Le Mars. Drawings and specifications may be obtained at the above office or from the custodian of site at Le Mars. O. Wenderoth is supervising architect.

MARBLE ROCK, IA.—Surveys are being made by the Power Engineering Co., of Minneapolis, Minn., in Marble Rock, for the proposed dam and power house.

MOUNT VERNON, IA.—The Wapsie Pwr. & Lt. Co. of Mount Vernon is extending its 33,000-volt transmission line from Stanwood to Tipton, a distance of about 7 miles. The transmission line passes through Lisbon, Mechanicsville and Stanwood and supplies electricity in these towns.

SABULA, IA.—The installation of an electric-lighting system in Sabula is under consideration, energy to operate the same to be supplied by the People's Gas & El. Co., of Savanna, Ill. The town of Sabula will have to bear the cost of erecting the transmission line from Savanna and the cable across the Mississippi River, the cost of which is estimated at about $8,000.

STOCKTON, IA.—The Davenport & Muscatine Interurban Ry. Co. contemplates furnishing electricity in Stockton for lamps and motors.

JOPLIN, MO.—A special election will be held April 15 to vote on the proposition to issue $60,000 in bonds for improvements to the municipal electric-light plant and extension to the street-lighting system in Joplin.

MARSHALL, MO.—The City Council has engaged Henrici, Kent & Lowry, of Kansas City, consulting engineers, to appraise the local electric-light plant and also to give an estimate of the cost of installing a new plant of sufficient output to meet the demands of the city.

RIDGEWAY, MO.—Plans are being prepared by Rollins & Westover, Midland Building, Kansas City, Mo., for an electric-light plant for Ridgeway. The cost of the proposed plant is estimated at $15,000.

ST. CHARLES, MO.—At an election held recently the proposition to grant the Mississippi River Pwr. Co. a 20-year franchise to furnish electricity here was carried. The company was also awarded a contract for lighting the streets of the city for a period of ten years.

EDGEMONT, S. D.—The Dakota Pwr. Co., of Rapid City, has been granted a franchise to supply electricity for lamps and motors to the city of Edgemont, the Black Hills division point of the Chicago, Burlington and Quincy system. The company proposes to build a main conduit from its plant at Big Bend, on Rapid Creek, south to Hill City, Custer, Minnekahta and Edgemont.

INTERIOR, S. D.—The installation of an electric-light plant in Interior is under consideration.

OACOMA, S. D.—A company has been organized in Oacoma to install and operate an electric-light plant. J. E. Kennedy is president of the company.

ROCKHAM, S. D.—At a special election held recently the Town Board was authorized to make arrangements for the installation of street lamps.

WHITE, S. D.—The special committee appointed by the Commercial Club to make investigations as to the cost of installing an electric-light plant and water-works system has presented its report to the club.

GRESHAM, NEB.—At the spring election to be held in April, the proposition of purchasing the local electric-light plant will be submitted to the voters. Dr. W. N. Hylton, owner of the plant, has offered it to the village for $4,000.

ARKANSAS CITY, KAN.—The Arksansas City Gas & El. Co. has submitted a proposition to the Board of City Commissioners offering to furnish and maintain an ornamental street-lighting system for $5,000 per year, under a ten-year contract. The plans provide for the erection of ornamental standards carrying three-lamp clusters.

BEATTIE, KAN.—The local electric-light plant and garage building, owned by Harry D. Hockman, was recently destroyed by fire, causing a loss of about $5,000.

MOLINE, KAN.—At a special election held recently the proposition to issue bonds for a municipal electric-light plant and water-works system was carried. Plans and specifications for this work, it is expected, will be ready by May 1. The Benham Engineering Co., American National Bank Building, Oklahoma City, Okla., is consulting engineer.

RUSSELL, KAN.—We are informed that the city of Russell does not contemplate issuing bonds for a municipal electric-light plant as published in the issue of March 22. The city installed a plant over a year ago.

Southern States

KINSTON, N. C.—The City Council is contemplating calling an election to vote on the proposition to issue bonds, the proceeds to be used for improvements to the municipal electric-light plant, sewer extensions and street paving.

CAMDEN, S. C.—Plans have been completed for the construction of an electric-light plant and water-works system, for which bonds were recently voted. The cost of the electric plant is estimated at $35,000 and that of the water works at $80,000. R. W. Mitcham is engineer.

ORANGEBURG, S. C.—The proposition to issue $60,000 in bonds to remove and erect the electric-light, power and water-works plant from the present site to one on municipal property adjacent to the Edisto River will be submitted to the voters on April 29.

ATLANTA, GA.—The city of Atlanta is contemplating the installation of a 600-kw electric generating plant in the river pumping station, at a cost of $9,500, to furnish electricity to operate the pumping station. R. C. Turner is city electrician, and R. M. Clayton is chief of construction department.

ATHENS, GA.—The citizens have petitioned the Athens Ry. & El. Co. to extend its street-car line to Barberville, a suburb of the city.

AUSTELL, GA.—The City Council has entered into a contract with the J. B. McCrary Co., of Atlanta, Ga., to furnish electricity for lamps and motors.

GIRARD, GA.—The City Council is considering the question of establishing a municipal electric-light plant and water-works system. A $45,000 bond issue is proposed.

ROYSTON, GA.—The Franklin Lt. & Pwr. Co. has petitioned the State Railroad Commission for permission to issue $150,000 in capital stock. The water rights, partially completed plants, contracts and franchises of the J. B. McCreary Co., of Atlanta, Ga., are to be turned over to the Franklin Lt. & Pwr. Co. for 1494 shares of this stock. The contracts and franchises are in Royston, Canton, Hartwell, Lavonia, Bowersville, Carnesville and Bowman.

JACKSONVILLE, FLA.—The Jacksonville Trac. Co. is considering making several extensions to its street-railway system.

ST. PETERSBURG, FLA.—Surveys are being made by W. W. Barton, of Tarpon Springs, for an electric railway from St. Petersburg to Indian Rocks. Thomas E. Lucas and S. R. Morey, of St. Petersburg, and M. Joel McMullen, of Largo, are interested in the project.

DRESDEN, TENN.—At an election to be held April 24 the proposition to issue $24,000 in bonds, the proceeds to be used for the installation of an electric-light plant, will be submitted to the voters.

GLEASON, TENN.—The installation of an electric-light plant in Gleason is under consideration.

ROGERSVILLE, TENN.—The Hydro-El. Pwr. Co., recently incorporated, will soon begin work on the development of a water-power 4 miles east of Rogersville. The company expects to purchase machinery and equipment at once.

BIRMINGHAM, ALA.—The Birmingham Wtr., Lt. & Pwr. Co. has submitted a proposition to the city commission offering to furnish the city with electrical energy for primary power with 24-hour service at 1 cent per kw-hr, and at 6 mills for secondary power during nine months in the year.

TUSCALOOSA, ALA.—It is reported that the contract for the construction of the power plant for the Birmingham-Tuscaloosa Ry. & Utilities Co. in Tuscaloosa has been awarded to the General El. Co., to cost $140,000. The whole project will involve an expenditure of about $5,000,000. Fred S. Morris, of Morris Brothers, bankers, is at the head of the railway company.

HARRISON, ARK.—The Harrison El. Lt. & Ice Co. contemplates installing new equipment, including an electric generator. The company has recently issued $35,000 in capital stock.

SULPHUR SPRINGS, ARK.—The contract for construction of the new municipal electric-light and water plant has been awarded to R. M. Gilbraith for $19,161.

NEW ORLEANS, LA.—Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until April 22 for conduits and wiring system in the United States Marine Hospital, New Orleans, La., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian, New Orleans. O. Wenderoth is supervising architect.

BRISTOW, OKLA.—Bonds to the amount of $25,000 have been voted for the installation of an electric-light plant in Bristow.

DALLAS, TEX.—The Dallas El. Lt. & Pwr. Co. will begin the work at once of placing underground all wires on Main, Elm and Commerce Streets from Pearl Street West to the Houston River. The total cost of the work is estimated at $1,000,000.

FOWLERTON, TEX.—Preparations are being made for the installation of an electric-light and power plant and an ice factory in Fowlerton. Work will soon begin on a water-works system.

NACOGDOCHES, TEX.—The city of Nacogdoches has purchased the plant of the Nacogdoches Lt. & Pwr. Co. for $25,000, to be owned and operated by the municipality.

SAN ANTONIO, TEX.—Plans have been prepared by the San Antonio Gas & El. Co. and the San Antonio Trac. Co. for extensions and improvements to their systems, involving an expenditure of $300,000. About $200,000 will be expended by the Traction company for the purchase of new street cars, double-tracking of its present lines, etc. The remaining $100,000 will be used for improvements to the electric-lighting system and extensions to gas mains.

Pacific States

ARLINGTON, WASH.—Plans and estimates have been submitted to the Council by Lewis C. Kelsey, engineer, Selling Building, Portland, Ore., for the installation of a lighting system and improvements to the water-works system here.

BREMERTON, WASH.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 3 for four electric traveling bridge cranes and two electric traveling wall cranes for the general foundry, navy yard, Puget Sound, Wash. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named. The estimated cost of the work is $17,000. H. R. Stanford is chief of bureau.

EVERETT, WASH.—The Everett Ry., Lt. & Wtr. Co. will make improvements to its reservoir, involving an expenditure of about $20,000.

KIRKLAND, WASH.—Application will be made to the Town Council by the Puget Sound Trac., Lt. & Pwr. Co., of Bellingham, for a franchise to furnish electricity for lamps, heat and motors in Kirkland. A transmission line is now being erected between Snoqualmie and Kirkand.

OLYMPIA, WASH.—The Olympia Lt. & Pwr. Co. has started condemnation proceedings against A. H. Chambers for the purpose of securing 10 acres of land with a view of enlarging its dam and reservoir at Tumwater.

SEATTLE, WASH.—Bonds to the amount of $425,000 have been voted by the city of Seattle for an auxiliary steam plant for the lighting department.

WENATCHEE, WASH.—Work, it is stated, will begin within thirty days by the Great Northern Ry. Co. on the construction of a large power plant in Chelan Gorge, to cost about $7,000,000. The proposed plant will develop 100,000 hp and will be used to operate the lines of the Great Northern Railway in this territory. Robert Herzog is chief hydraulic and electrical engineer.

COTTAGE GROVE, ORE.—A committee has been appointed to make investigations with a view to installing an electric fire-alarm system here.

GRANT'S PASS, ORE.—Bonds to the amount of $200,000 have been sold by the city, the proceeds to be used for the construction of a municipal electric railway from Grant's Pass to Crescent City on the coast via the Illinois Valley. Practically the entire right-of-way has been secured and 26 acres have been purchased in Grant's Pass for a terminal site.

HOOD RIVER, ORE.—A number of property owners are contemplating the construction of an electric line from the business section of the city to the residential district. Alva Day, W. L. Smith and A. F. Howes are interested in the project.

PORTLAND, ORE.—Improvements are contemplated by the Portland Ry. & Lt. Co. involving an expenditure of about $4,000,000. About $1,500,000 will be expended on the lighting plant.

PORTLAND, ORE.—Preparations are being made by the Portland Ry., Lt. & Pwr. Co. to erect a one-story reinforced-concrete electrical switching station on East Thirteenth Street, corner of Ochoco Avenue, to cost $4,000.

PORTLAND, ORE.—If an agreement reached recently by Mayor Rushlight and members of the street-lighting committee of the City Council and representatives of the Portland Ry., Lt. & Pwr. Co. meets

the approval of the City Council, provision will be made for the immediate installation of 388 new arc lamps in various parts of the city.

PORTLAND, ORE.—The West Coast Engineering Co., of Portland, has been awarded the contract by the city of Portland for installing a lighting system on the new Broadway Bridge across the Willamette River, at a cost of about $21,000. The plans provide for 200 two-lamp cast-iron brackets and 50 five-lamp electroliers, on which will be used 100-watt Mazda lamps. A decorative system will also be installed, consisting of approximately 7000 4-cp carbon lamps.

ST. JOHN'S, ORE.—The Washington Wtr. Pwr. Co., of Spokane, has applied to the City Council for a 50-year franchise and a contract for street-lighting for a period of ten years. Under the terms of the contract the company agrees to furnish 60 lamps of 100 cp at $1,800 per year.

SILVERTON, ORE.—At an election to be held May 5 the proposition to issue $50,000 in bonds, the proceeds to be used to establish a municipal electric-light plant, will be submitted to a vote.

BAKERSFIELD, CAL.—The San Joaquin Lt. & Pwr. Co. is planning to extend the local street-railway system to the Kern River oil fields and to the new Standard Oil refinery on the north side of the river.

CHICO, CAL.—Application has been made to the City Council by A. C. Agnew, representing the Sierra El. Pwr. Co., for a 50-year franchise, to erect transmission lines to distribute electricity for lamps and motors in Chico. Mr. Agnew stated that the company had a power site near Manton, Tehama County.

CORONA, CAL.—The Pacific El. Ry. Co., of Los Angeles, has applied to the city trustees for a franchise to construct and operate an electric railway in Corona. George E. Pillsbury is chief engineer of the company.

GRIMES, CAL.—A. Young and A. Butler are securing rights-of-way for the Oro El. Corpn., of San Francisco, for a steel-tower transmission line from its new power project in Plumas County to some point on San Francisco Bay. A branch line will run from Grimes to Colusa, a distance of 10 miles.

HERMOSA BEACH, CAL.—City Engineer Atchley has recommended the expenditure of $5,000 for a fire-alarm system and police-signal system and $10,000 for an electric light and power distribution system here.

LAKEPORT, CAL.—A committee, consisting of Trustees F. H. Boggs, W. C. Moore and William R. Lane, has been appointed to investigate the matter of equipping the municipal water-works system with electrically driven pumping plant.

LIVERMORE, CAL.—The Livermore Wtr. & Pwr. Co. has applied to the State Railroad Commission for permission to sell its plant to the Pacific Gas & El. Co., of San Francisco. The price given is $142,000.

LOS ANGELES, CAL.—The Board of Education will receive bids for furnishing boilers and power machinery for shop work. T. J. McGonigle is purchasing agent.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Corpn. expects to purchase a large quantity of line material for both 60,000-volt and 15,000-volt transmission service. W. J. Gracey is purchasing agent.

LOS ANGELES, CAL.—The Los Angeles Gas & El. Corpn. has applied to the State Railroad Commission for authority to issue $900,000 in bonds, the proceeds to be used as follows: For the purchase of the Valley Gas & Fuel Co., $175,000; purchase of additional gas generating set and new equipment, $169,000; extension of the distributing system for new consumers, $600,000, and extension of the electrical distributing system, $280,000.

MARYSVILLE, CAL.—The Oro El. Corpn., of Oroville, has applied for a franchise to erect and operate an electric distributing system in Marysville. If granted a franchise, the company agrees to spend $300,000 on its system here.

PASADENA, CAL.—The City Council has adopted a resolution authorizing the erection of ornamental lamp standards on Los Robles Avenue from the north to the south city boundaries, a distance of 4 miles.

PASADENA, CAL.—The Home Tel. Co. has authorized improvements to the local exchange involving an expenditure of about $50,000. Three new sections of switchboard will be added to the exchange and a complete power plant installed.

PLEASANTON, CAL.—The question of issuing $16,000 in bonds to establish a municipal electric light and power plant is under consideration. S. A. Winnegar is clerk.

POMONA, CAL.—The State Railroad Commission has authorized the Pomona Valley Tel. & Teleg. Union, which serves the cities of Pomona, Chino, Claremont, Lordsburg and San Dimas, to issue $100,000 in bonds, the proceeds to be used to retire existing bonds and for extension to its system.

REEDLEY, CAL.—The State Railroad Commission has granted the Reedley Tel. Co. permission to purchase the interests of E. W. Crosby and to make extensions, involving an expenditure of $11,000.

RIVERSIDE, CAL.—The Board of Public Utilities has awarded two contracts for furnishing energy to the city. The Southern Sierras Pwr. Co. was awarded the contract for supplying electricity in the district south of Arlington Avenue, amounting to 1000 hp per year, with the privilege of increasing the amount, at 1 cent per kw-hr., and the Southern California Edison Co. the contract for furnishing energy to the rest of the city at 85 mills per kw-hr. The Southern Sierras Power Co. will erect a substation at Arlington.

SAN FRANCISCO, CAL.—The lighting department of the Panama-Pacific Exposition is planning the installation of a powerful searchlight on Mount Tamalpais, to be used during the exposition in 1915.

SAN FRANCISCO, CAL.—The City El. Co., of San Francisco, has been authorized to extend its service conduits on Market, Larkin and Howard Streets, on condition that the city may take over such conduits at any time upon payment of their value to the company.

SANTA ROSA, CAL.—The Petaluma & Santa Rosa Ry. Co. has applied to the State Railroad Commission for authority to issue $80,000 in bonds and notes to the amount of $64,000, to be used for financing the construction of an electric railway from Liberty Station to a new station to be known as Two Rocks, a distance of 5½ miles.

VENICE, CAL.—The city engineer has been instructed to prepare estimates for the erection of concrete lamp-posts to be located throughout the entire Colegrove district. The posts will carry cluster lamps like those used in Venice.

CALDWELL, IDAHO.—The Caldwell Trac. Co. will extend its railway around the south side of Deer Flat Reservoir.

FORT COLLINS, COL.—At an election held March 25 the proposition to issue bonds for a municipal electric-light plant was defeated.

ORDWAY, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co., of Pueblo, has been granted a franchise to extend its transmission lines from Rocky Ford to Ordway. The company is making some extensions to farming communities on a cost division basis.

Canada

CALGARY, ALTA.—The Calgary Pwr. Co., Ltd., is developing another water-power on Bow River at Kananaskis Falls, 2 miles above the Horseshoe Falls, to run in parallel with existing plants at Horseshoe Falls. The new plant will have an output of 12,000 hp under a 70-ft. head, and will be equipped with two 6000-hp Allis-Chalmers Bullock single vertical turbines, set in concrete scroll chambers, equipped with Allis-Chalmers Bullock waterwheel governors; two Swedish General Electric 5100-kva, 12,000-volt, three-phase, 60-cycle, 164 r.p.m. generators; switchboard equipment not yet awarded. The company is doing its own construction work. The Calgary Pwr. Co. supplies energy in bulk to the city and to the plants of the Canada Cement Co., Ltd., at Exshaw and Calgary. H. A. Moore is manager and chief engineer.

VANCOUVER, B. C.—Notices for applications for water rights have been filed as follows: For the British-Pacific Hydro-Electric & Tramways Ltd., of Victoria, 1200 cu. ft. of water from the Englishman's River, near Parkesville, B. C.; Peter Daniel Carr, of Telkwa, for 10 cu. ft. from Canyon Creek and to store same in a 4,500,000-gal. reservoir to be constructed; the Hope District Pwr., Lt. & General Devel. Co., 1000 cu. ft. from Coquahalla River and to store same in a 1000-acre-ft. reservoir at head of Coquahalla Canyon; Malcolm L. Meason, to take water from Lesser Dog Creek, Clinton, to store same in a 2000-acre-ft. reservoir on Lesser Dog Creek; the city of West Vancouver, B. C., for 200 miners' in. of water from Sisters' Creek and to store about 16,335,000 gals. in reservoir to be constructed; the Yale Land Syndicate, of Vancouver, 30 cu. ft. of water from Qualark Creek; Sydney Wtr. & Pwr. Co., to utilize water drawn from wells in North Saanich.

VICTORIA, B. C.—Sealed tenders will be received for forest branch telephone equipment until April 14 by the Minister of Lands as follows: For 300 miles No. 9, B. B., B. W. G. galvanized wire; 10 miles No. 12, E. B. B., B. W. G. galvanized-iron wire; 18,000 No. 37 Thomas split-tree insulators, or equal; 4125 1½-oz., 2-in. by 12-in. painted oak brackets, conforming to American Tel. & Teleg. Co.'s specifications; 25 coils, 200 ft. per coil, No. 18, galvanized; 30 standard ground rods. Tenders on above material to be based on price f.o.b., Vancouver, and ready for delivery on May 1, 1913. A number of telephones, both wall and portable, are to be purchased. For further information address H. R. McMillan, chief forester, Forest Branch Department, Victoria.

WINNIPEG, MAN.—Tenders will be received until May 15 by the Board of Control, at the office of M. Peterson, secretary, Winnipeg, for furnishing and erecting in the generating station at Point du Bois three-phase generators for direct connection to double reaction turbines and spare parts to same. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street, Winnipeg.

TORONTO, ONT.—The Toronto El. Lt. Co. has filed plans at the city hall for an extensive underground system. The plans provide for a network of underground wires in the district bounded by Spadina Avenue on the west, Sherbourne Street on the east, the bay on the south and Wellesley Street and St. Alban's Street on the north.

TORONTO, ONT.—The Dominion government has approved the application of the Toronto & Niagara Pwr. Co. for permission to construct its proposed transmission line along the Lake Shore Road, but under special conditions, which provide that all wires must be strung on one set of poles or towers; this to apply to all existing wires of whatever company. The Toronto & Niagara Pwr. Co. must pay the entire cost of the unification system. At any later date, should the government so order, the company must at its own expense place the wires underground.

Miscellaneous

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, until April 15, for furnishing induction motors, auto starters or compensators, automatic oil switches, copper cable, journal bearings, brake rod connection pins, steel keys for brakeshoes, etc., under Circular No. 769. Proposals will also be received until April 19 for induction and direct-current motors, copper louver panels and rubber valves under Circular No. 770. Blanks and general information relating to the above circulars may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

New Industrial Companies

THE ELECTROCHEMICAL PRODUCTS COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $1,000,000 by J. F. Curran, C. S. Long and R. C. McAvoy.

THE HAZAZER ELECTRIC COMPANY, of New York, N. Y., has been incorporated by Edgar W. Hazazer, Harry H. Bascom and Samuel W. McCarter, 318 West Fifty-seventh Street, New York. The company is capitalized at $10,000 and proposes to install electric equipment, etc.

THE INDUSTRIAL LIGHTING EQUIPMENT COMPANY, of Indianapolis, Ind., has been incorporated by Felix Devere, Flora M. Devere, Claude Shaw and others. The company is capitalized at $10,000 and proposes to manufacture electrical appliances.

THE LATROBE ELECTRIC STEEL COMPANY, of Latrobe, Pa., has been incorporated with a capital stock of $300,000. The officers of the company are: Marcus Saxman, president; Charles W. Guttzeit, vice-president; F. B. McFeely, secretary, and Ira C. Shallenberger, treasurer.

New Incorporations

DENVER, COL.—The Western Colorado Pwr. Co. has been incorporated with a capital stock of $5,000 and will operate in La Plata, San Miguel, San Juan, Ouray, Montrose, Delta, Montezuma, Mesa and Dolores Counties. The company, it is said, will soon begin construction work to develop power for the agriculture districts it will tap. M. A. Lewis, D. E. Wilson and H. B. Teller, of Denver, are among the incorporators.

SEBREE, KY.—The Sebree Lt. & Milling Co. has been granted a charter with a capital stock of $20,000. The incorporators are: John B. Ramsay, J. J. Korb and M. J. Ramsey.

STERLINGTON, N. Y.—The Sterlington El. Ltg. Co., Inc., of Rockland County, has been incorporated with a capital stock of $10,000 by Benjamin Moffat, Jr., George T. Carpenter and Robert B. Potter, of Tuxedo.

Trade Publications

DISCOUNT AND PRICE BOOK.—The Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., has issued a 104-page discount and price book, which will be found a useful adjunct to its 1912 catalog, No. 28.

SHURLOCK SOCKETS.—Pass & Seymour, Inc., Solvay, New York, have issued an attractive pamphlet telling of the Shurlock socket, "the socket that locks." Its sub-title fittingly describes its contents: "Facts entertainingly told for the man who wishes to protect himself against the loss of lamps." And these facts are based on real experience in hotels, offices and other large buildings, where lamps are sometimes taken as souvenirs, or in manufacturing plants, where they are sometimes traded off by employees.

FURNACE ARCHES.—The Carr ventilated furnace arch is made the subject of a neat little pamphlet issued by the Evens & Howard Fire Brick Company, St. Louis, Mo. This furnace arch has been designed to withstand the high temperatures of furnace practice and is said to aid in smoke prevention as well as lengthening the service of the arch by from 100 to 400 per cent over that of arches constructed in the usual manner. An excellent picture is shown of a Stirling boiler equipped with ventilated arch and another of a water-tube boiler with Dutch-oven setting similarly equipped. A number of railway and light companies as well as electrical manufacturing firms are using the Carr type of furnace arch.

ICE-MAKING AND REFRIGERATING MACHINERY.—Current interest in refrigerating and ice-making machinery makes timely the appearance of the catalog of the Carbondale Machine Company, Carbondale, Pa. Comprehensive information as to the methods of operation of the Carbondale exhaust-steam machine is followed by a description of the various types of machines made by the company and a number of its auxiliaries. Central-station managers desirous of reducing the cost of operation of their plant or of increasing their revenue will find this catalog of interest. Many illustrations showing plants installed for various classes of refrigeration and ice-making enhance the attractiveness of this 64-page publication.

Business Notes

THE BUCKEYE ENGINE COMPANY, Salem, Ohio, has appointed the Federal Engineering Company, 1112 House Building, Pittsburgh, Pa., agent for the Pittsburgh district for the sale of steam and gas engines and other products of its manufacture.

DEARBORN CHEMICAL COMPANY.—Mr. Paul T. Payne, who has been associated with the Dearborn Chemical Company, Chicago, for many years, and for the past ten years has been engaged in various capacities in the sales department of the company, has lately been appointed district sales manager with headquarters at the Indianapolis office, Hume-Mansur Building. Mr. Payne will direct the sales of the several company branches in that district.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

American Association for the Advancement of Science. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

American Electric Railway Association. Secretary, H. C. Donecker, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, H. C. Donecker, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cooperstown, N. Y., June 23-27.

American Physical Society. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

American Society of Heating and Ventilating Engineers. Secretary, W. W. Macon, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

Arkansas Association Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 5, 6 and 7.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

Association of Iron and Steel Electrical Engineers. Secretary, James Farrington, Steubenville, Ohio.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

Canadian Electrical Association. Secretary, C. E. Bowden, Birkbeck Building, Toronto, Ont., Can. Annual convention, Port Arthur, Can., June 23-25.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

Electric Club of Chicago. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Spring meeting, Chicago, May 26-28.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Z[illegible] 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th Street, New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St. New York. Meeting, first Wednesday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Annual convention, Kansas City, April 17, 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 27-29, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Chicago, June 2-6, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga. Annual meeting, Macon, Aug. 14-16.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 19-21.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss. Annual meeting, Natchez, April 21-23.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, H. H. McKinney, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York. Meeting executive committee, May 13, 1913.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Secretary-treasurer, J. W. Neave, Salisbury, N. C. Second annual convention, Charlotte, N. C., April 15 and 16.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 25, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,056,789. APPARATUS FOR PRODUCING OZONE; S. Held, Chicago, Ill. App. filed Aug. 10, 1911. Designed to be connected to the ordinary light circuit and variable in capacity by increasing or diminishing number of electrodes.

1,056,830. TREATMENT OF GASES; H. D. Rankin, Joliet, Ill. App. filed July 6, 1909. For producing compounds of nitrogen; e. g., nitric acid.

1,056,850. WELDING MACHINE; F. A. Stevens and S. E. Bouchard, Providence, R. I. App. filed Feb. 7, 1912. Special arrangement of the electrodes and clamping of the work.

1,056,852. SYSTEM OF CONTROL; N. W. Storer, Pittsburgh, Pa. App. filed June 6, 1911. Control of single-phase railway motors by liquid rheostats.

1,056,854. RAIL BOND; C. R. Sturdevant, Worcester, Mass. App. filed May 5, 1911. Tubular terminal with conductor passed there-through; rail is bonded to the splice bar.

1,056,862. ELECTRIC FUSE; M. C. Warren, Coffeyville, Kan. App. filed July 31, 1912. Insulating block destroys arc by dropping down between the terminals when the fuse wire is burned out.

1,056,866. CIRCUIT-CHANGING MECHANISM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Relay makes one set of connections when energized by momentary impulses and other connections when energized by prolonged or steady currents.

1,056,879. SYSTEM OF ELECTRIC-MOTOR CONTROL; G. Baehr, Montclair, N. J. App. filed Dec. 29, 1909. For elevators; current automatically interrupted at predetermined point in travel of car and automatically retarded, dependent upon speed at time of interruption.

1,056,894. LOCOMOTIVE DRIVING CONNECTION; K. F. Elers, Pittsburgh, Pa. App. filed May 9, 1911. Flexible connection between an electric motor and a substantially concentric shaft or axle.

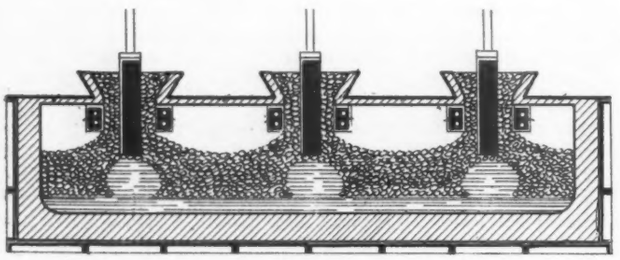
1,056,900. PROCESS OF DESULPHURIZING ORES AND METALS; A. E. Greene, Chicago, Ill. App. filed Aug. 5, 1910. Pig-iron treated in electric furnace with suitable slag and a reducing agent.

1,056,921. SYSTEM OF CONTROL FOR DYNAMO-ELECTRIC MACHINES; J. N. Mahoney, Wilkinsburg, Pa. App. filed May 22, 1911. Continuously circulates the electrolyte in a plurality of liquid rheostats.

1,056,933. ELECTRIC COOKER; F. C. Perkins, Buffalo, N. Y. App. filed Oct. 10, 1911. Special heat-insulating means.

1,056,946. AUTOMATIC WATER-LEVEL ALARM; S. O. Saunders, New Bridge, Ore. App. filed Nov. 1, 1911. Sealed casing immersed in the water and containing a circuit-controlling float.

1,056,951. FIRE ALARM; R. E. Sherer, Luck, Wis. App. filed April 14, 1911. Fusing of conducting member is hastened by surrounding conducting member with inflammable material.



1,057,239.—Electric Furnace.

1,056,987. ELECTRIC CURLING IRON; A. C. Gough, Pocatello, Idaho. App. filed July 15, 1912. Heating elements seated in casing and spaced therefrom by wire wrapped end and center bearings.

1,056,992. ELECTRIC SEMAPHORE MECHANISM; W. K. Howe, Rochester, N. Y. App. filed Dec. 3, 1909. Motor with detent mechanism to avoid shock and jar when signal is brought to rest.

1,056,993. ALTERNATING-CURRENT TRACK-CIRCUIT SIGNALING; W. K. Howe, Rochester, N. Y. App. filed Sept. 30, 1911. Insulated joint breakdown protector.

1,056,995. ELECTRICAL TESTING APPARATUS; H. G. Ingram, Juniata, Pa. App. filed March 21, 1912. Receiver having automatic winding spool carrying flexible cord.

1,056,998. INSULATOR; B. G. Jamieson and C. A. Keller, Chicago, Ill. App. filed May 4, 1909. Bolt head is incased in insulating medium which rests against the conductor.

1,057,016. ELECTRODE; K. Tornberg, Lynn, Mass. App. filed March 27, 1911. Provides air space between an outer shell and an inner metallic shell carrying material yielding a luminous arc springing from a molten pool.

1,057,025. LAMP SOCKET; G. Wright, Schenectady, N. Y. App. filed Oct. 9, 1912. Projections on insulating base engage in a pocket or depression in the shell.

1,057,035. SELECTIVE SYSTEM; E. R. Carichoff, Schenectady, N. Y. App. filed Aug. 30, 1909. Means carried by the car for automatically reducing the potential when it is on a high-potential section of the line.

1,057,038. RAILWAY SIGNALING APPARATUS; W. J. Cook, Denver, Col. App. filed April 22, 1911. Safety light is covered by the semaphore when in the danger position.

1,057,041. MERCURY LAMP-STARTING DEVICE; J. T. H. Dempster, Schenectady, N. Y. App. filed Nov. 9, 1905. High voltage is supplied successively and automatically to each of the lamps in series.

1,057,045. VARIABLE-SPEED ELECTRIC DRIVE FOR PLANERS; A. D. Du Bois, Chicago, Ill. App. filed Jan. 13, 1906. Resistance automatically cut in and out to vary speed of the working and return strokes of the planer.

1,057,046. ELECTRODE; G. W. Elmen, Schenectady, N. Y. App. filed Aug. 30, 1906. Metal tube with filling of iron oxide, rutile and chromite and one-quarter of 1 per cent of sodium fluoride.

1,057,049. RAILWAY SIGNAL; H. L. Funkhouser, Beaver Falls, Pa. App. filed Nov. 9, 1912. Semaphore controls track tappets, which in turn control cab signal lights.

1,057,054. ARC-LAMP ELECTRODE; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed March 4, 1911. Fusible luminous-arc material surrounded by a plurality of metallic shells in frictional contact with each other.

1,057,061. ROTOR WINDINGS FOR ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES; L. J. Hunt, Sandycroft, England. App. filed Aug. 10, 1909. For operating at different speeds.

1,057,077. TRANSFORMER; W. S. Moody, Pittsfield, Mass. App. filed March 2, 1910. Transformer with switching means divided into groups and switching means controlling the groups.

1,057,082. ELECTRICAL REDUCTION FURNACE; H H. Noble, San Francisco, Cal. App. filed July 2, 1912. Electrodes entered into the crucible through openings in the arch covers.

1,057,088. SHAPING FILAMENTS; R. O. Poag and W. W. Kirk, Cleveland, Ohio. App. filed June 15, 1912. Filament coiled under tension.

1,057,126. ELECTRICAL PROTECTIVE APPARATUS; A. F. Dixon, Newark, N. J. App. filed Dec. 24, 1910. For supporting heat coils, spark-gap arresters and other protective devices in a telephone exchange.

1,057,147. ELECTRIC SWITCH; H. Hansen, New York, N. Y. App. filed Jan. 31, 1912. Push-button snap switch with special locking and releasing devices for movable-switch contact.

1,057,155. ELECTRIC SWITCH AND CUT-OUT; J. S. Johnson, Utica, N. Y. App. filed Feb. 28, 1910. Fuses mounted in a rotatable fuse carrier.

1,057,176. ELECTRIC-LAMP SOCKET; F. E. Seeley, Bridgeport, Conn. App. filed Dec. 23, 1909. Key socket having a cam-reflexed contact with opening at bend therein to permit access to the securing screw.

1,057,178. CABLE-END BELL; E. O. Sessions, Chicago, Ill. App. filed Oct. 8, 1909. End of underground cable is protected adjacent to the joint with the aerial line by sealing it in insulating material.

1,057,179. SLEET CUTTER; C. J. Smith, Altoona, Ia. App. filed Nov. 1, 1911. Flanges of trolley wheel are held together yieldingly.

1,057,184. INSULATING MEANS; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 10, 1912. Plurality of concatenated horizontally disposed longitudinal insulators suspended in column.

1,057,208. RAILWAY SWITCH OR THE LIKE; C. O. Anderson, Omaha ,Neb. App. filed Feb. 28, 1910. Switch-operated motor has its armature shaft disposed transversely of the stock rails and yieldingly connected with the throw rod.

1,057,213. ELECTRIC FURNACE AND METHOD OF OPERATING SAME; G. H. Benjamin, New York, N. Y. App. filed April 9, 1912. Has heating chamber, reducing chamber and refining chamber; material forms resistant medium.

1,057,239. ELECTRIC FURNACE; A. Helfenstein, Vienna, Austria-Hungary. App. filed Jan. 12, 1912. Multiple-hearth type.

1,057,258. ELECTRIC SWITCH AND OUTLET BOX; O. Moessner, Philadelphia, Pa. App. filed May 25, 1912. U-shaped box sections held together by detachable clips.

1,057,276. ELECTRICAL MEASURING INSTRUMENT; L. T. Robinson and O. Holz, Schenectady, N. Y. App. filed June 9, 1909. Forms factor indicator for alternating-current circuits.

1,057,278. ART OF SYNCHRONIZING ALTERNATING-CURRENT GENERATORS; B. P. Romain, Newark, N. J. App. filed Dec. 8, 1909. Indicator moved by movable part of electrodynamometer and concealed from view when the currents are not in phase.

1,057,286. REVOLVING ELECTRICAL FURNACE WITH RESISTANCES ARRANGED DIAMETRICALLY; O. Serpek, Paris, France. App. filed July 23, 1912. Diametrical resistances in sections with beveled edges.

1,057,313. ALARM DEVICE FOR MEASURING INSTRUMENTS; S. Worliczek, Zolkiew, Austria-Hungary. App. filed April 30, 1912. For pressure gages; alarm pointer is adjusted by a worm and worm gear.

1,057,320. ELECTRIC SOCKET; F. Barr, New York, N. Y. App. filed Nov. 9, 1912. Recesses in side of the insulating base receive the circuit terminals; circuit terminal provided with strain-relieving finger.

1,057,367. ELECTRIC WATER PURIFIER; A. H. Van Pelt, Los Angeles, Cal. App. filed June 29, 1912. Water purified by electrolysis.

1,057,370. ELECTRIC FUSE LIGHTER; H. Bargman, Los Angeles, Cal. App. filed Dec. 29, 1910. Has fuse-penetrating points with switch mechanism controlling passage of current through such lighting points.

1,057,383. ELECTRICAL APPLIANCE FOR ACTUATING AND CONTROLLING DUMB-WAITERS; C. H. Larson, New York, N. Y. App. filed July 18, 1911. Elevating circuit or lowering circuit is automatically cut out when the other is in actual use.

1,057,386. DYNAMO-ELECTRIC MACHINE; E. M. Tingley, Pittsburgh, Pa. App. filed March 17, 1905. Cooling circulation is maintained from end chambers through constricted passages and out through exhaust ports in middle chamber of the structure.

1,057,394. ELECTRIC MOTOR; H. C. Ogle, Dexter City, Ohio. App. filed Feb. 20, 1912. Controller for the motor mounter on the armature shaft.